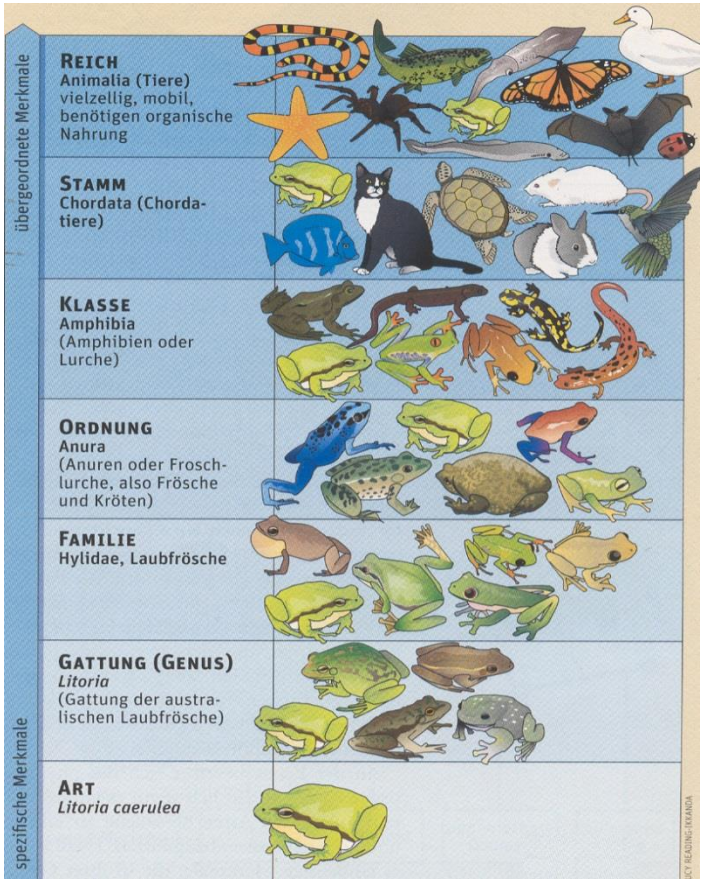
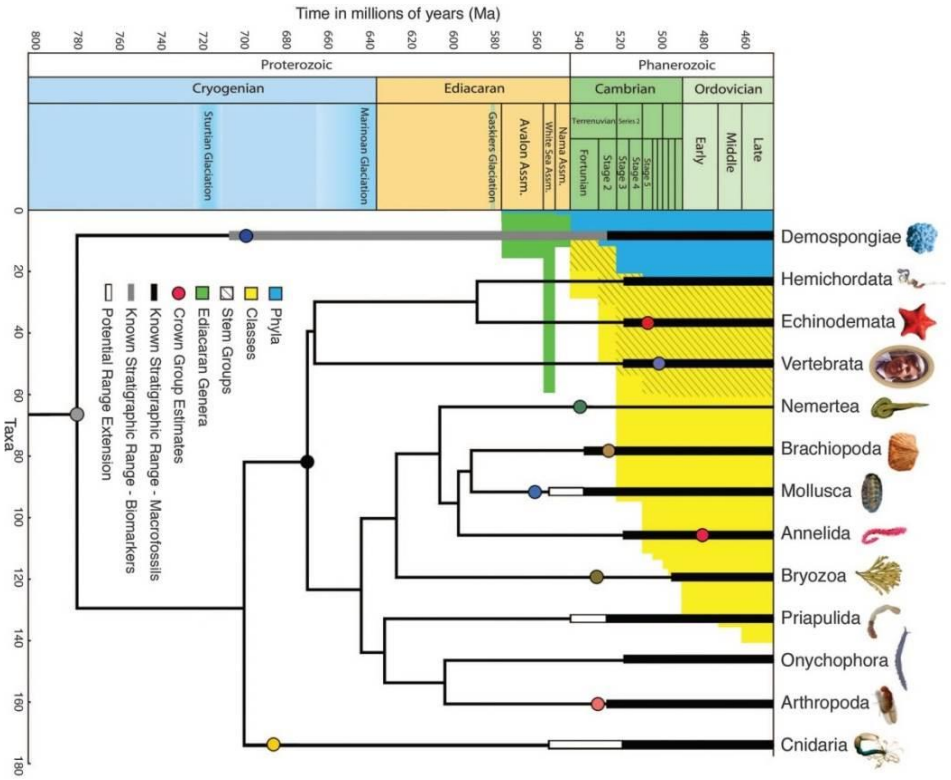
Systematische Zoologie
– oder Zoologische Systematik



- **eine Einführung ins Reich der Tiere**



Matthias Glaubrecht

CeNak
Centrum für Naturkunde

Systematische Zoologie

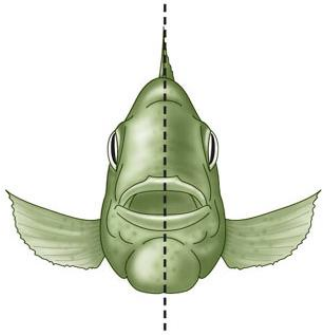
- **Die Vorlesung – *Was werden Sie hören ?***

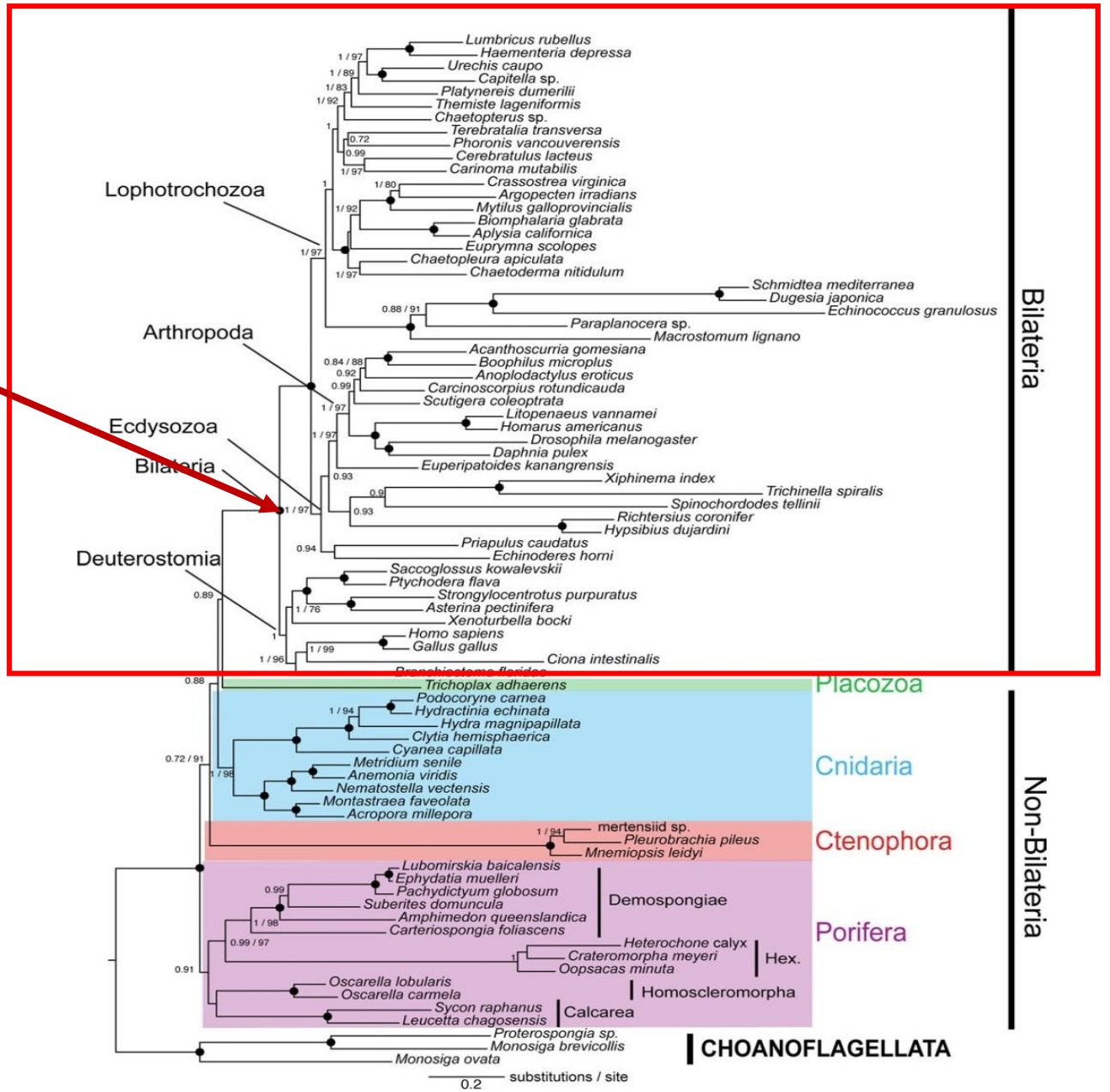
Biodiversität der Tiere 9:45-11:15 Großer Hörsaal
61-011 Systematische Zoologie

Termin	KW	Datum	Thema	
1	14	2. Apr.	Einführung Zool. Systematik, Protista	
2	15	9. Apr.	Einführung, Metazoa	
3	16	16. Apr.	Metazoa, Bilateria	Protostomia
4	17	23. Apr.	Platyzoa - Mollusca	
5	18	30. Apr.	Annelida - Nematoda	
6	19	7. Mai.	Ecdysozoa: Chelicerata	
7	20	14. Mai.	Crustacea	
		Christi Himmelfahrt 21. Mai		
8	22	28. Mai.	Myriapoda - Insecta	
		Pfingstunterbrechung 4. Juni		
9	24	11. Jun.	Deuterostomia, Echinodermata	Deuterostomia
10	25	18. Jun.	Acrania, Pisces - Amphibia	
11	26	26. Jul.	Reptilia - Aves	
12	27	02. Jul 20	Mammalia	
	30	24. Jul 20	Haupttermin (Freitag)	
	40	02. Okt 20	Wiederholungstermin (Freitag)	

Stammbaum der Metazoa

- **Bilateria**



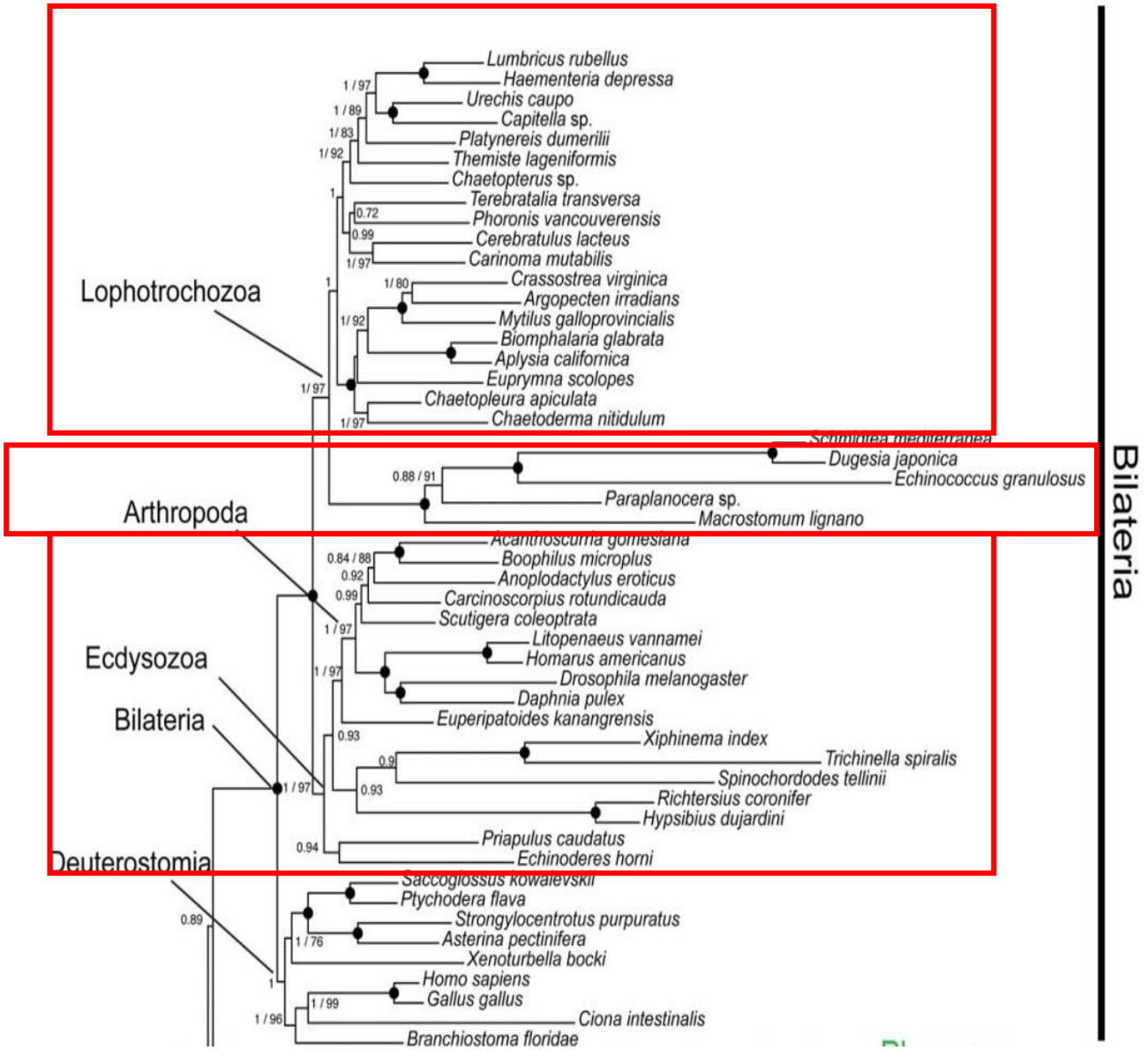


Pick et al. 2010. MBE

Die verwirrende Vielfalt der Namen

Stammbaum der Bilateria und drei „Überstämme"

- **Lophotrochozoa**
- **Platyzoa**
- **Ecdysozoa**



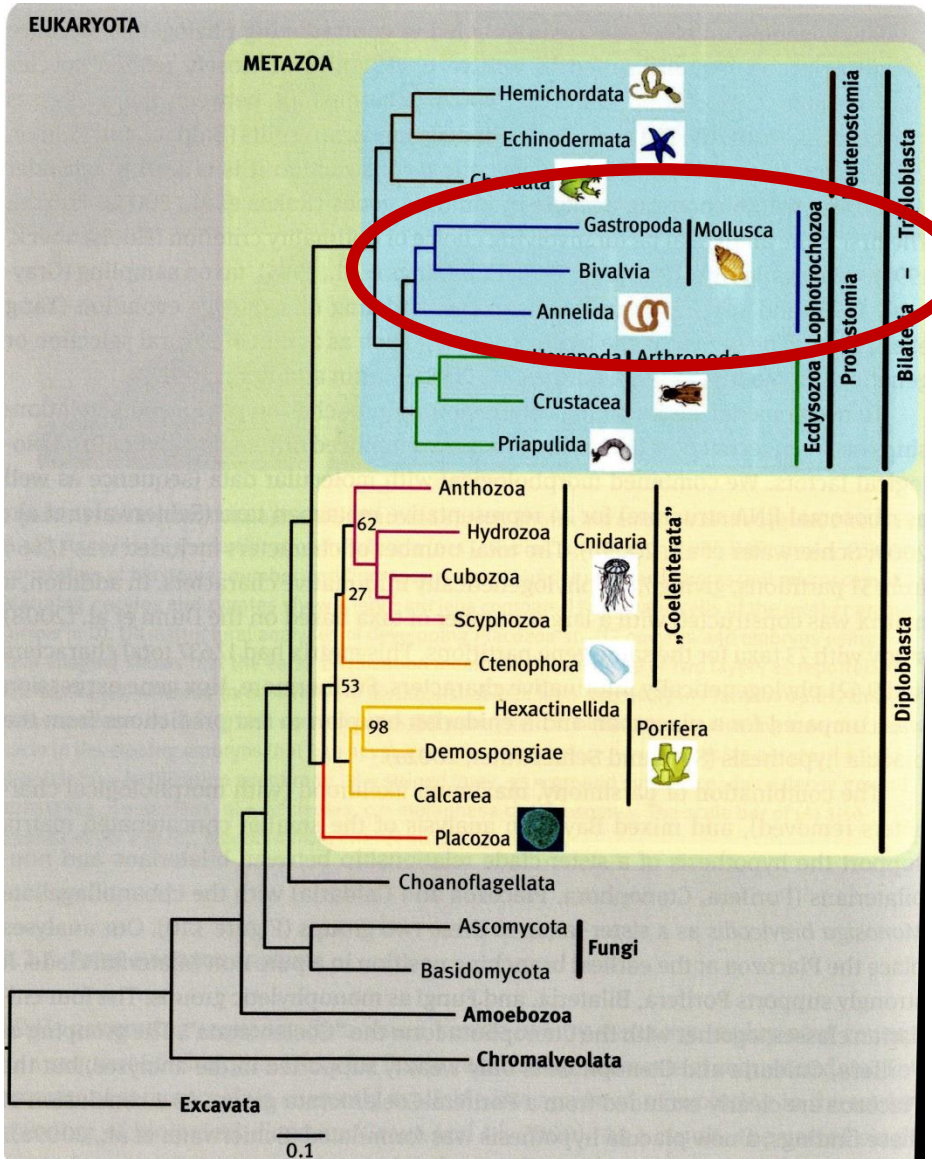
Pick et al. 2010. MBE

Stammbaum der Metazoa

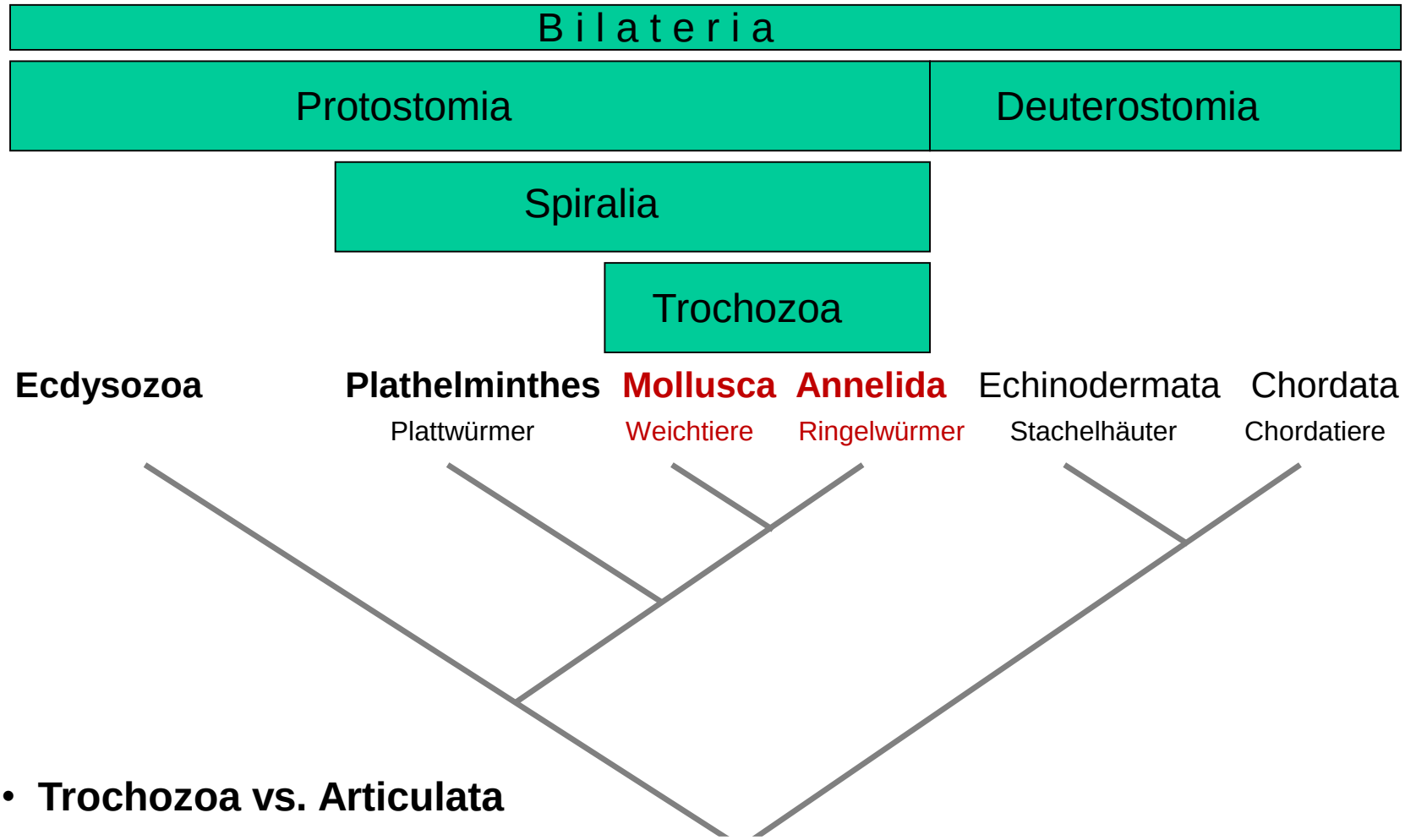
- **Lophotrochozoa**

  - **mit Spiralfurchung**

- **Ecdysozoa**

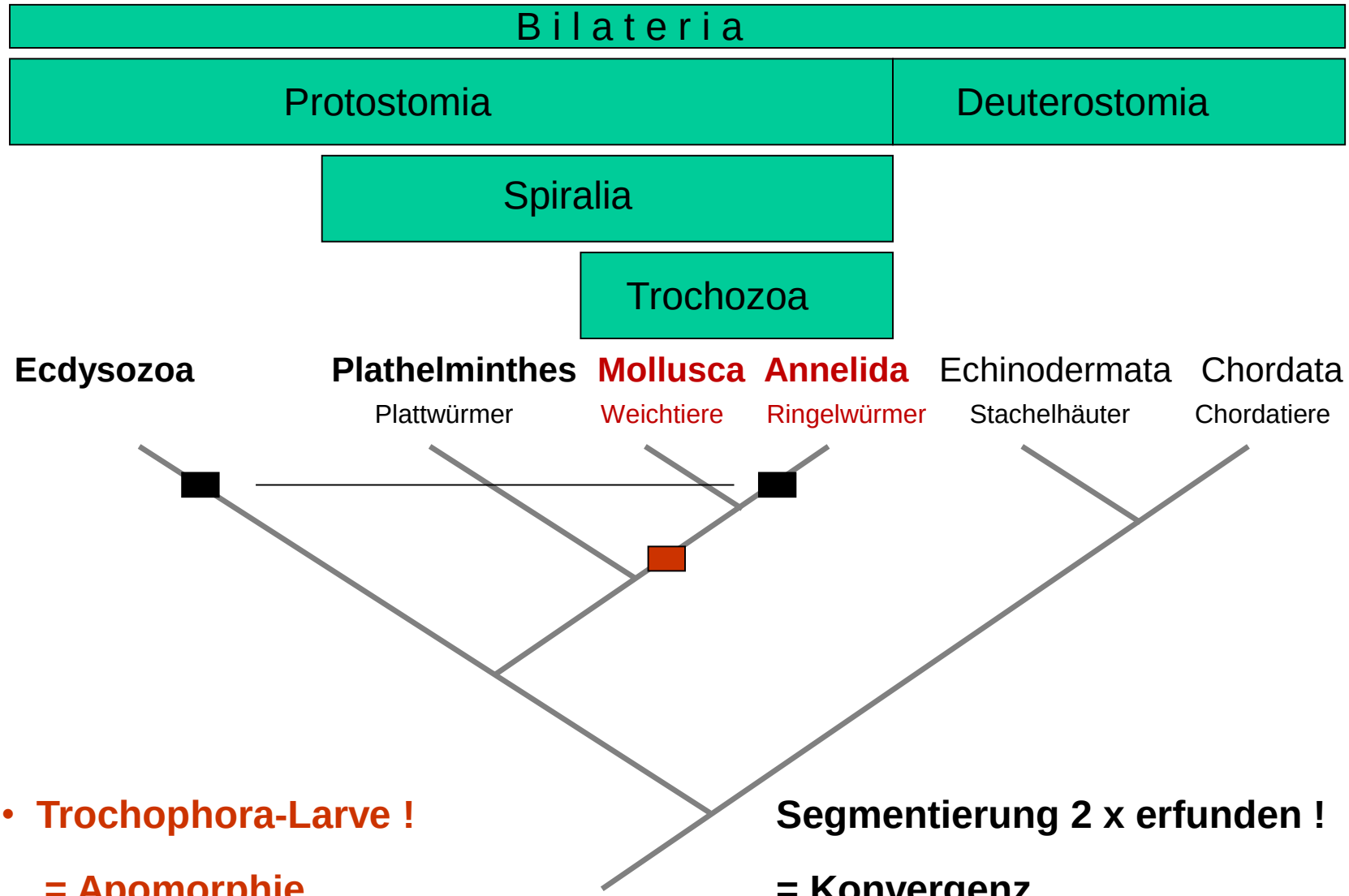


Die Trochozoa



- **Trochozoa vs. Articulata**
- **nicht segmentierte vs. segmentierte Tiere**

Trochozoa vs. „Articulata"



- **Trochophora-Larve !**

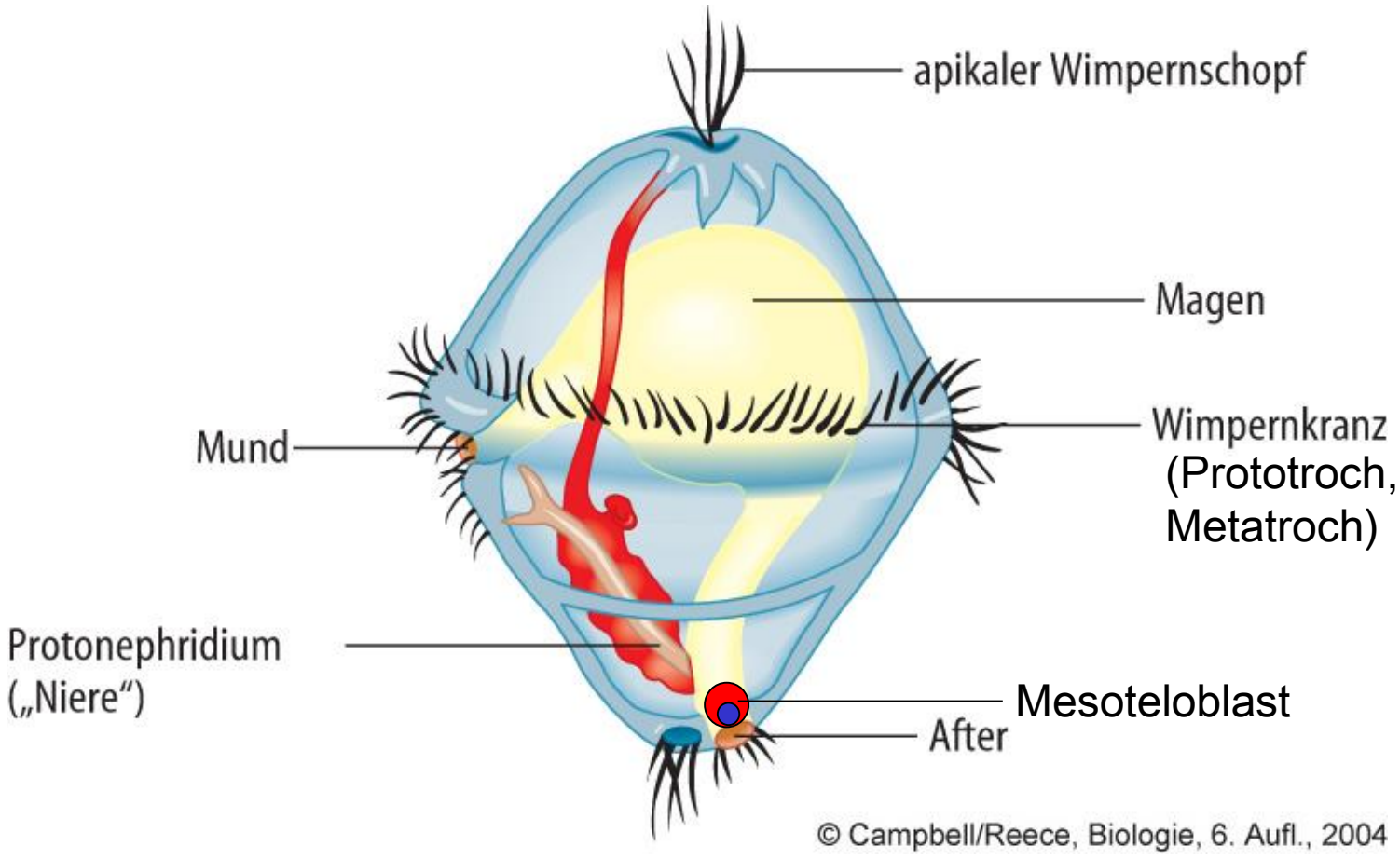
  = Apomorphie

Segmentierung 2 x erfunden !

= Konvergenz

Lophotrochozoa

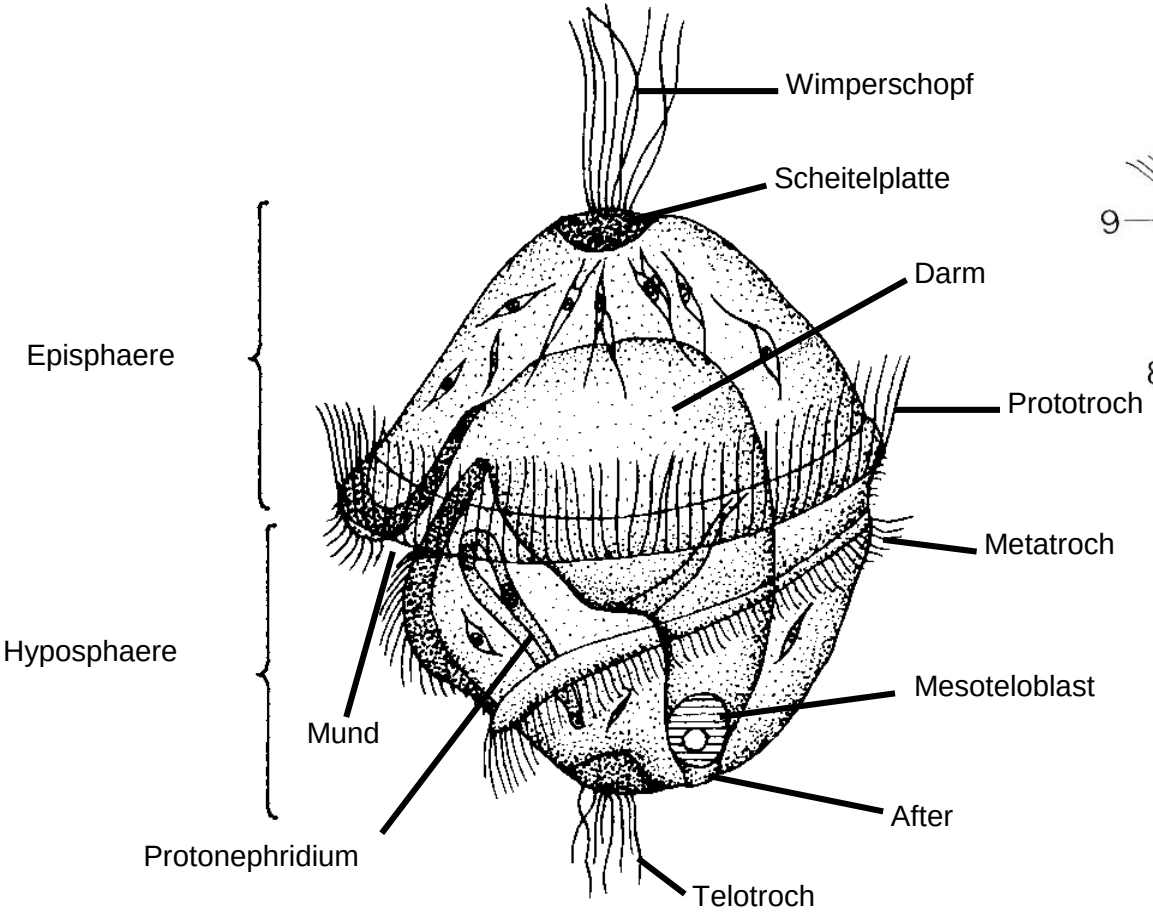
- **Trochophora-Larve**

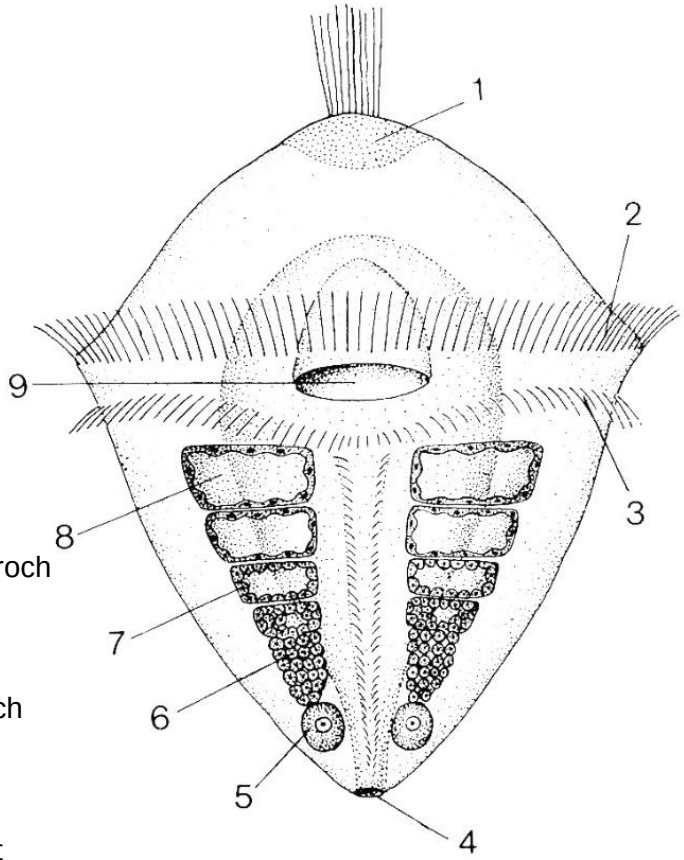


Embryonalentwicklung der Spiralia

- **Mesodermbildung**

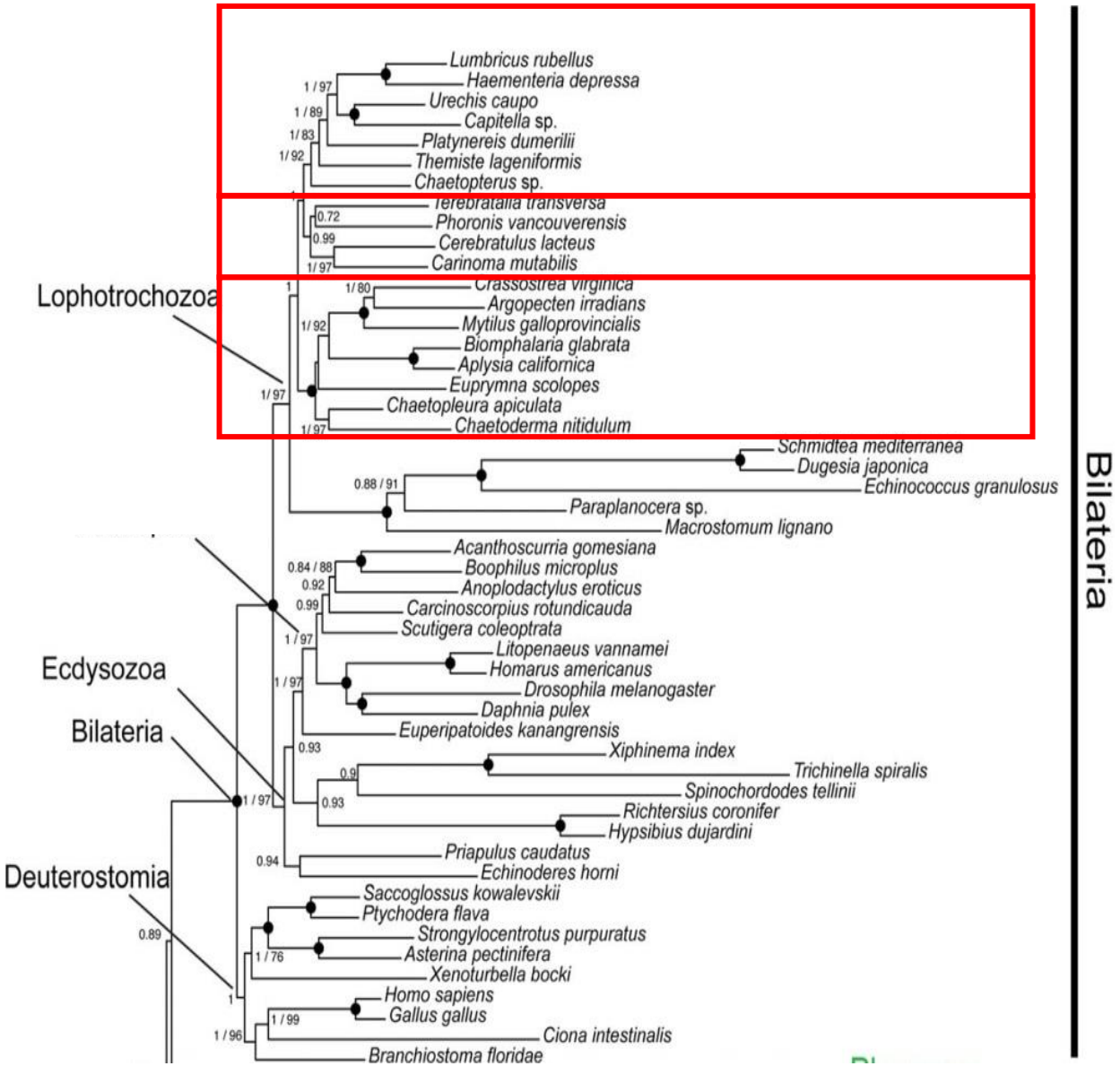
Trochophora-Larve





Stammbaum der Lophotrochozoa

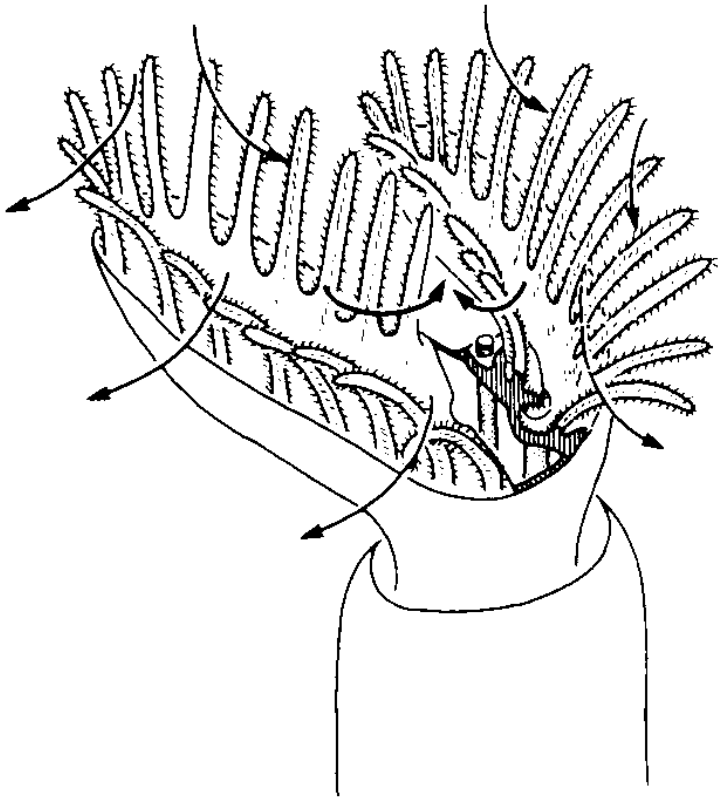
- **Annelida**
- **Tentaculata**
- **Mollusca**



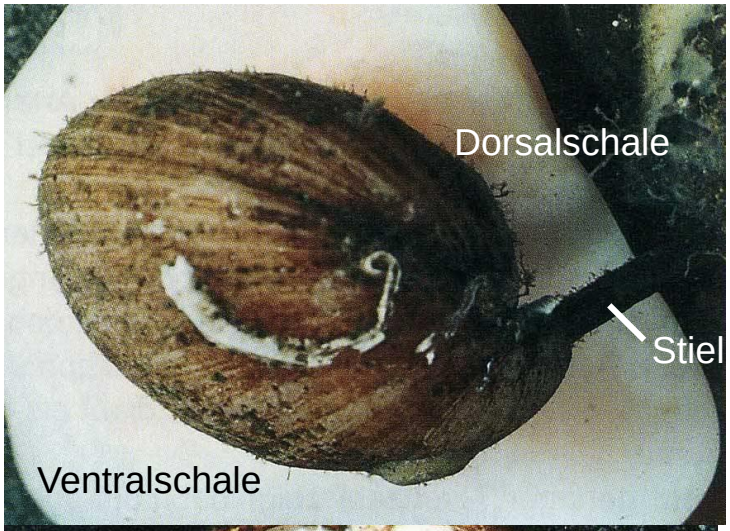
Pick et al. 2010. MBE

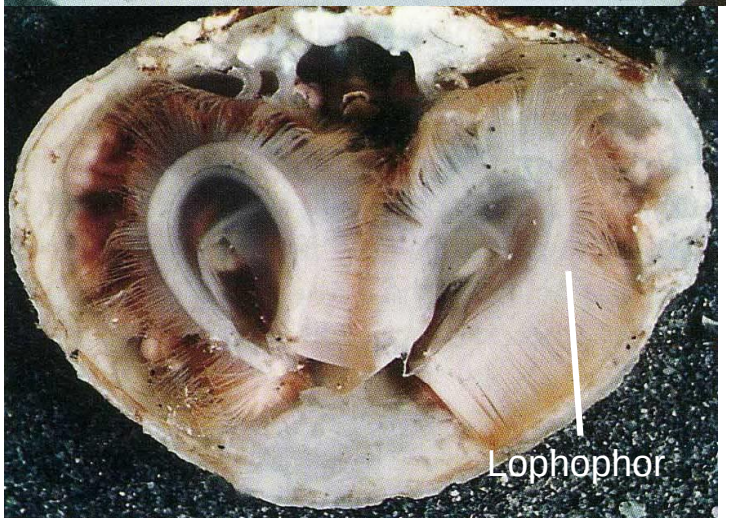
Lophotrochozoa (Tentaculata)

Lophophor

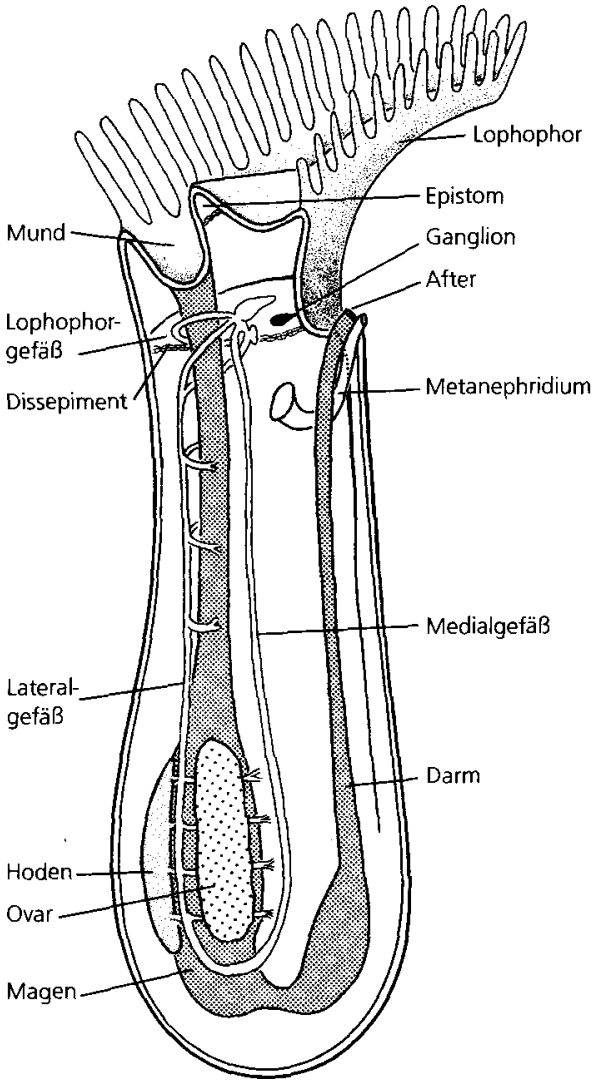


z. B. Brachiopoda

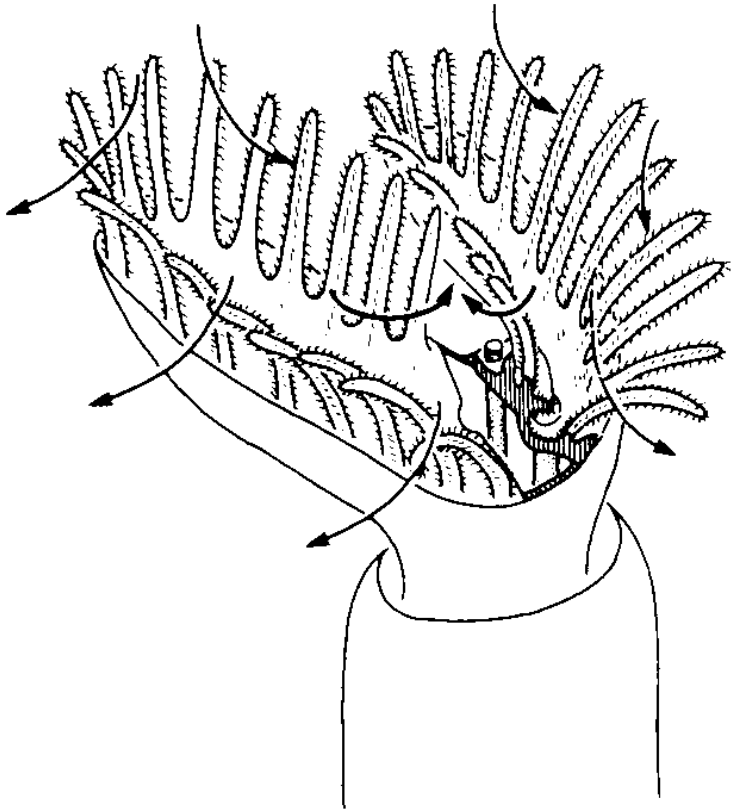




Lophophorata (Tentaculata)



Wasserstrom:



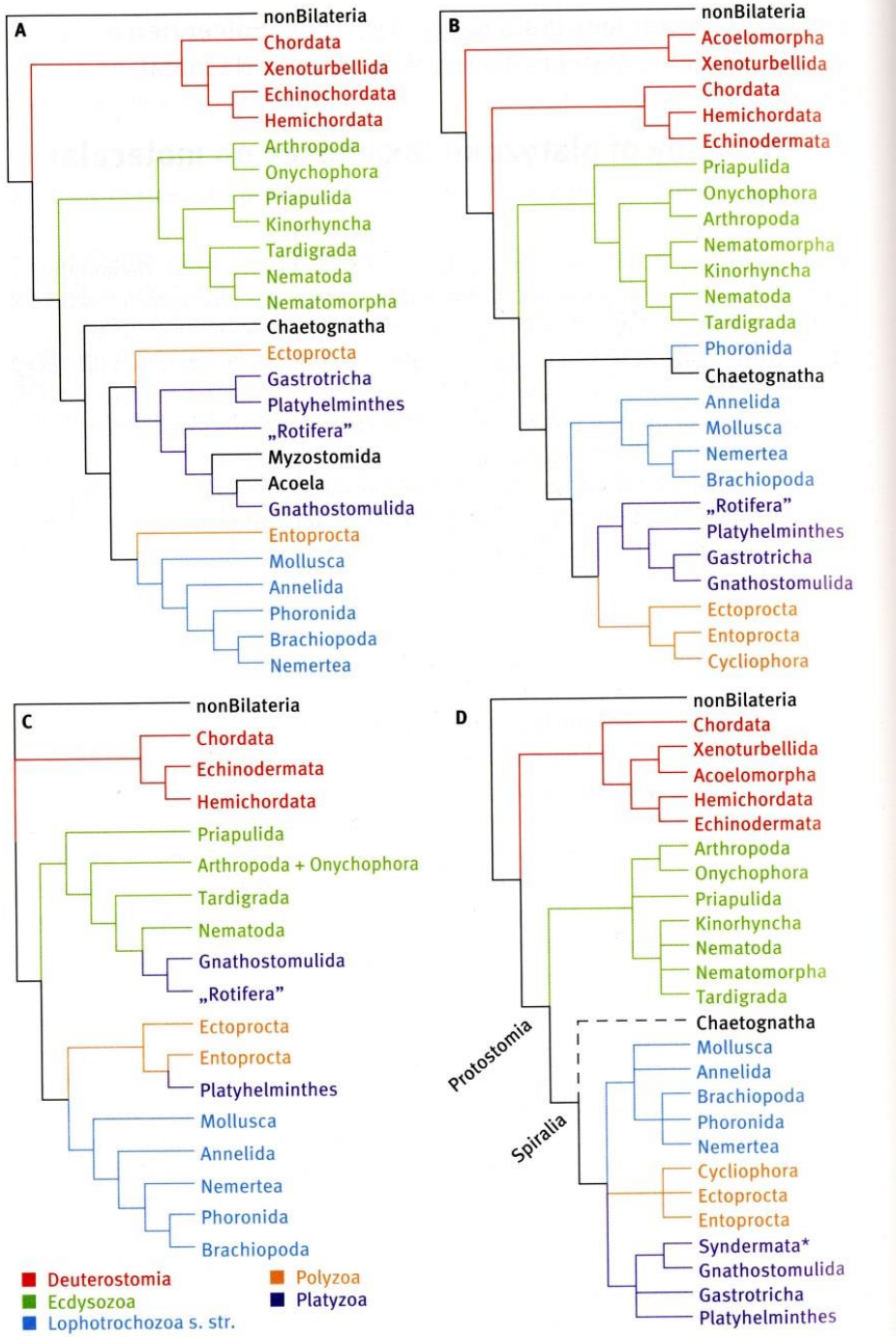
Lophotrochozoa

- **Von Moostierchen**

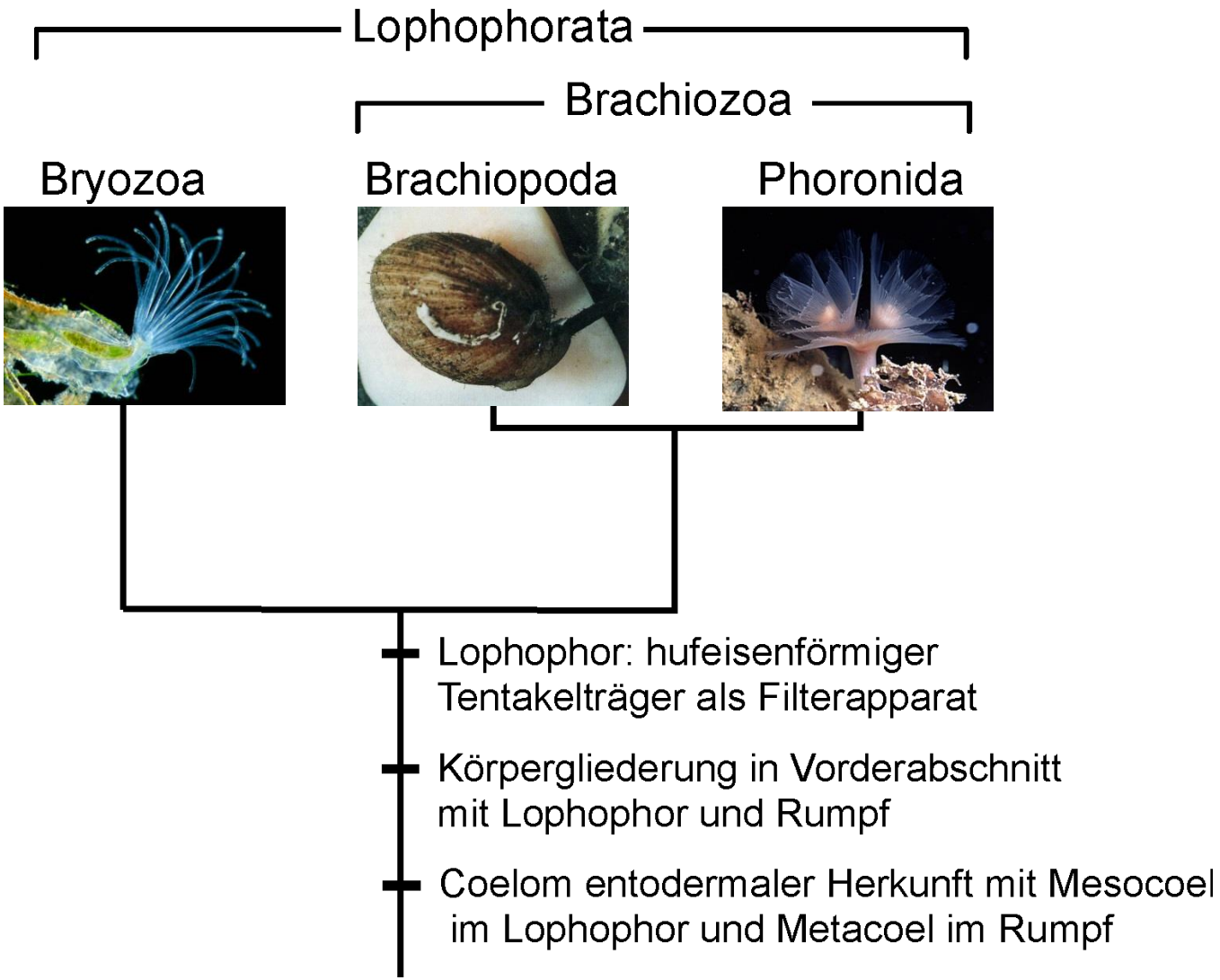
  Armfüßern

  Schnurwürmern

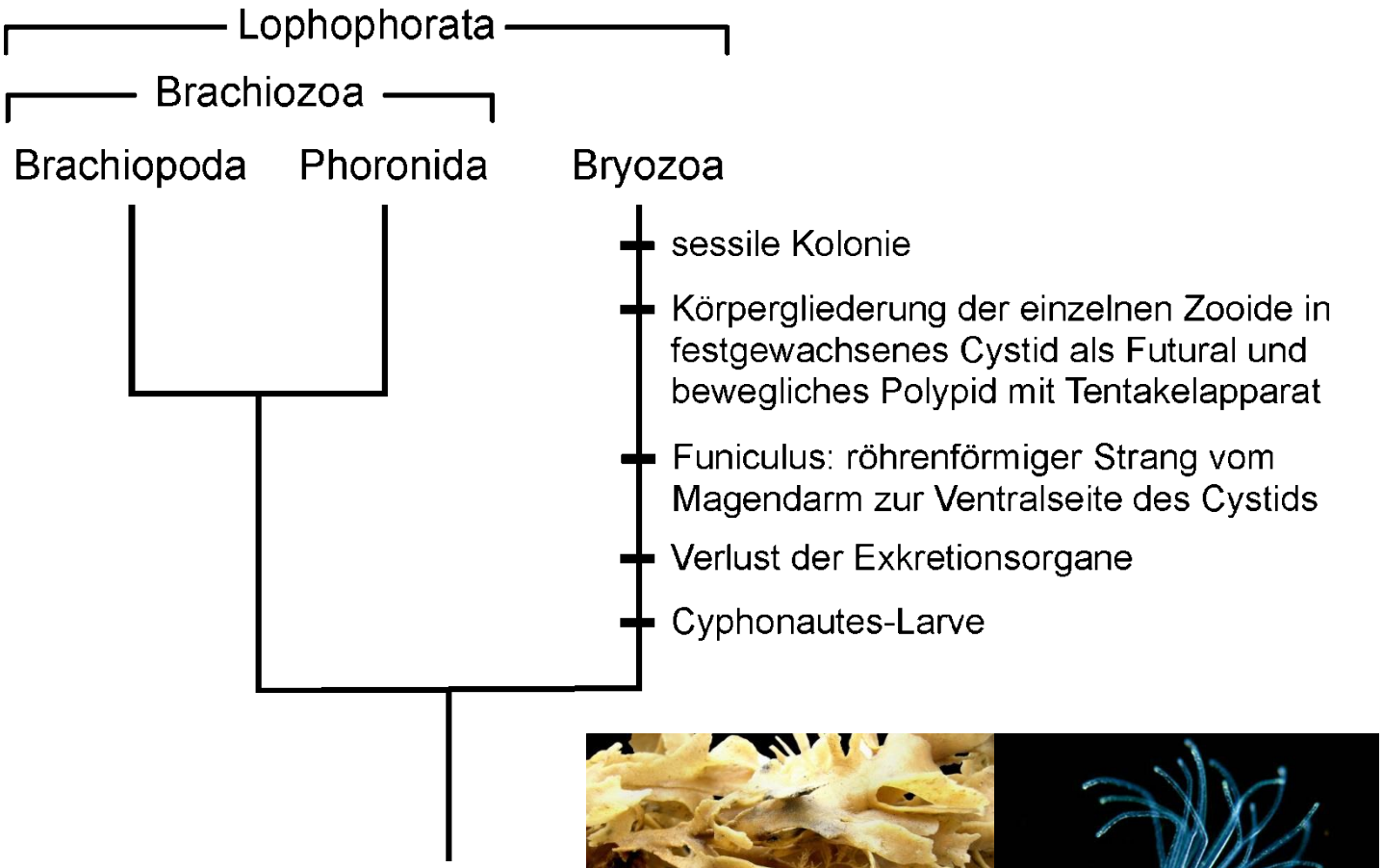
  („Meeresnymphen“)



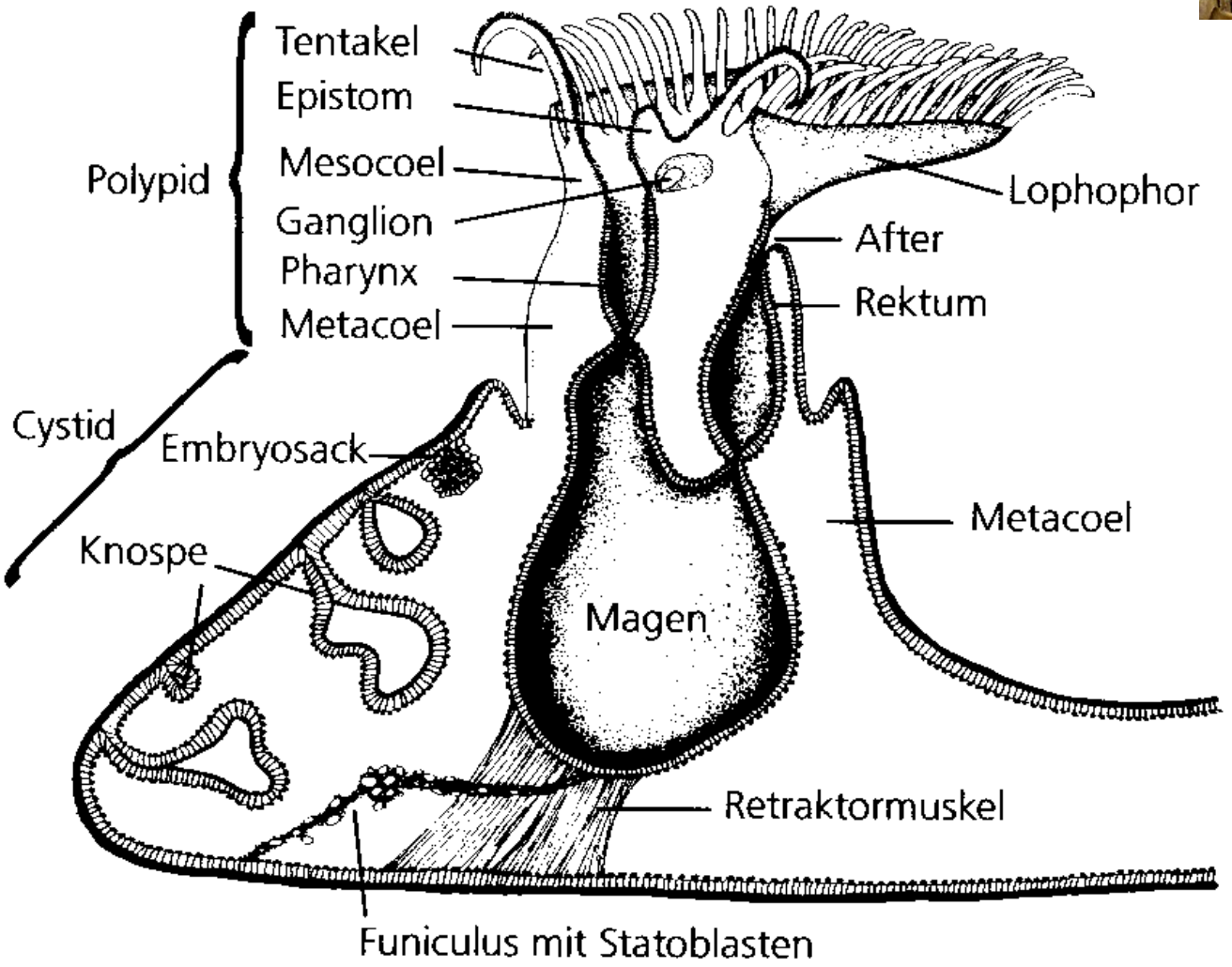
Lophophorata (Tentaculata)



Lophophorata (Tentaculata)

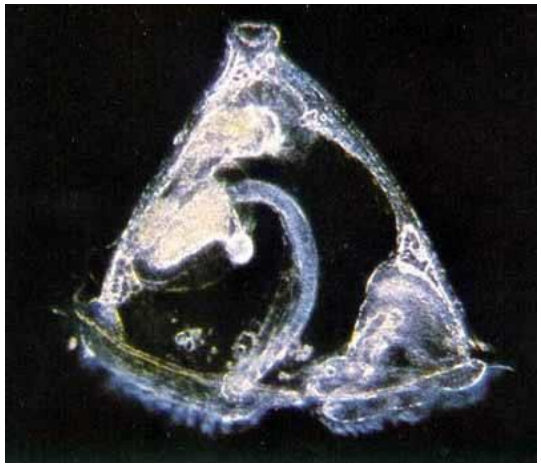


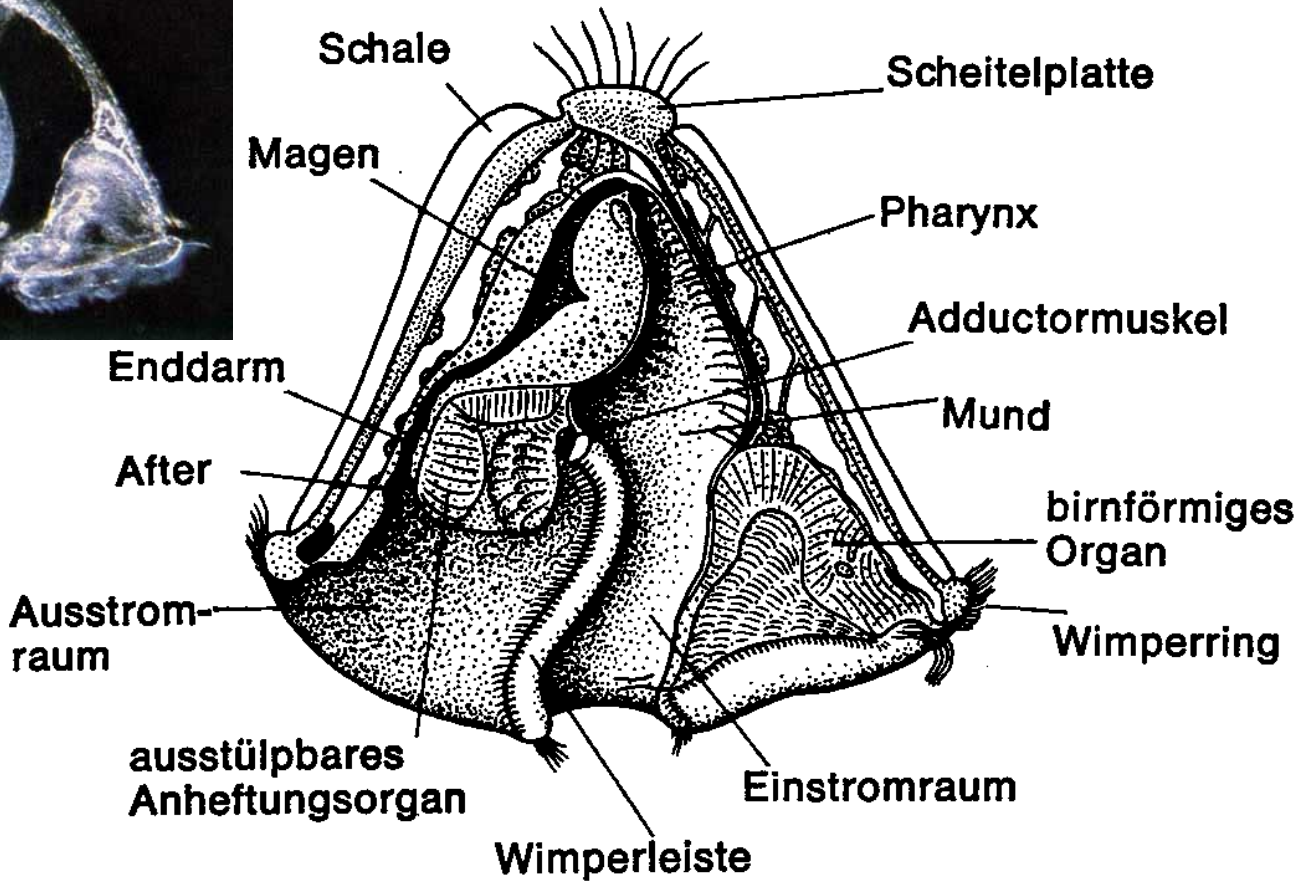
Bryozoa (Moostiere)



Bryozoa (Moostiere)

- **Cyphonautes-Larve**





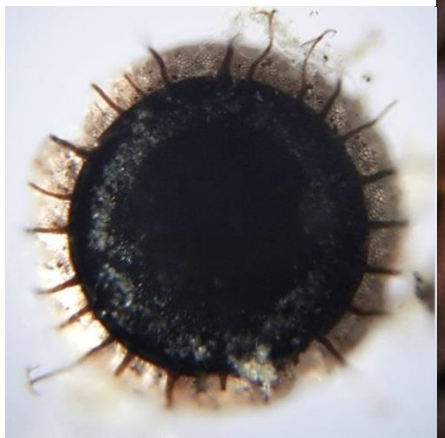
Bryozoa (Moostiere)

Bryozoa

Gymnolaemata | Phylactolaemata

- Verlust der Planktonlarve
- Entwicklung junger Kolonien in Embryosäcken adulter Organismen
- ungeschlechtliche Bildung von Statoblasten am Funiculus
- Süsswasserbewohner

Statoblasten



Plumatella

Bryozoa (Moostiere)

Bryozoa

Phylactolaemata

Gymnolaemata

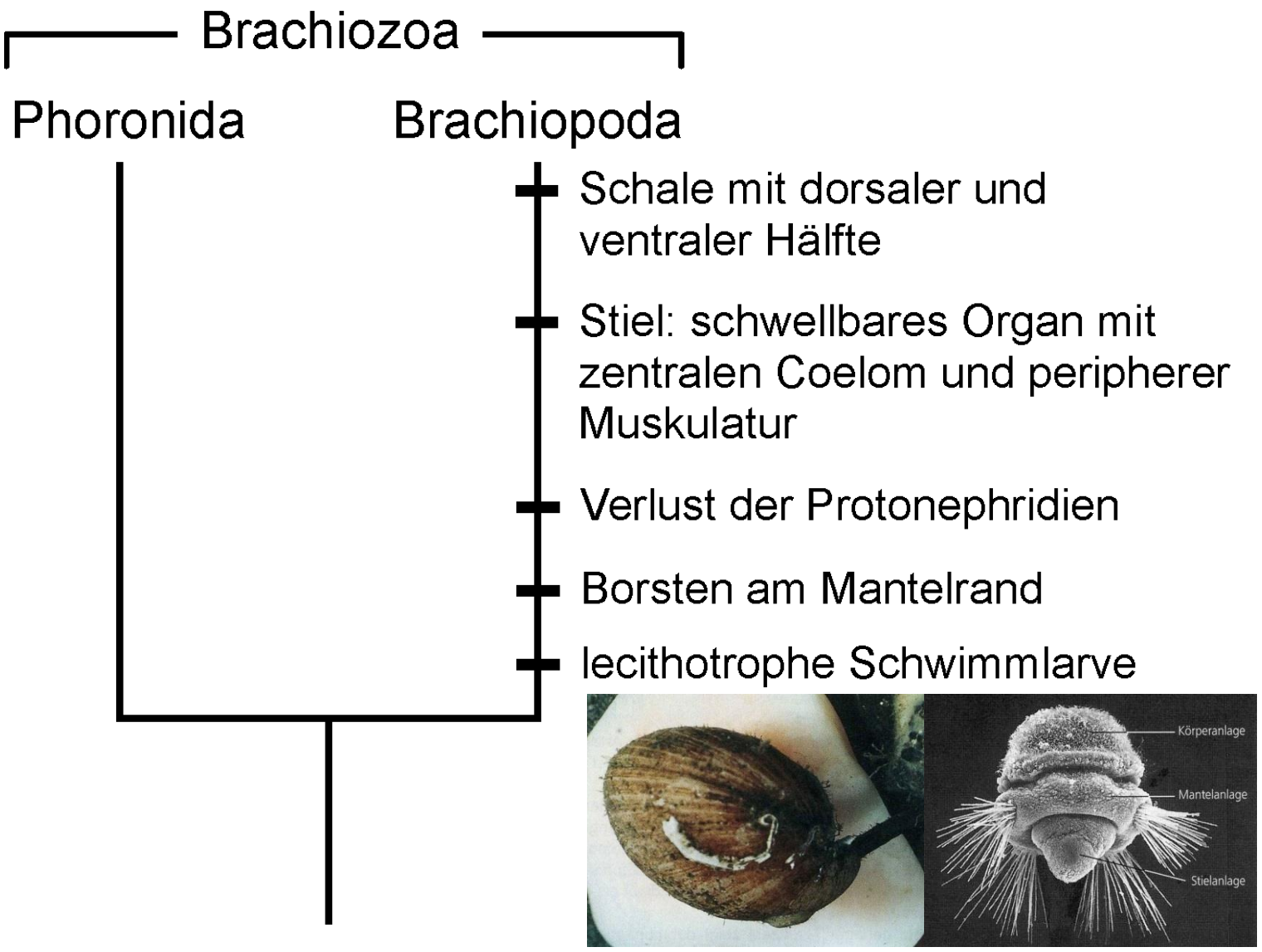
- ringförmig geschlossener Tentakelkranz um die Mundöffnung
- Verlust des Epistoms (Kehldeckel) über der Mundöffnung

Plumatella

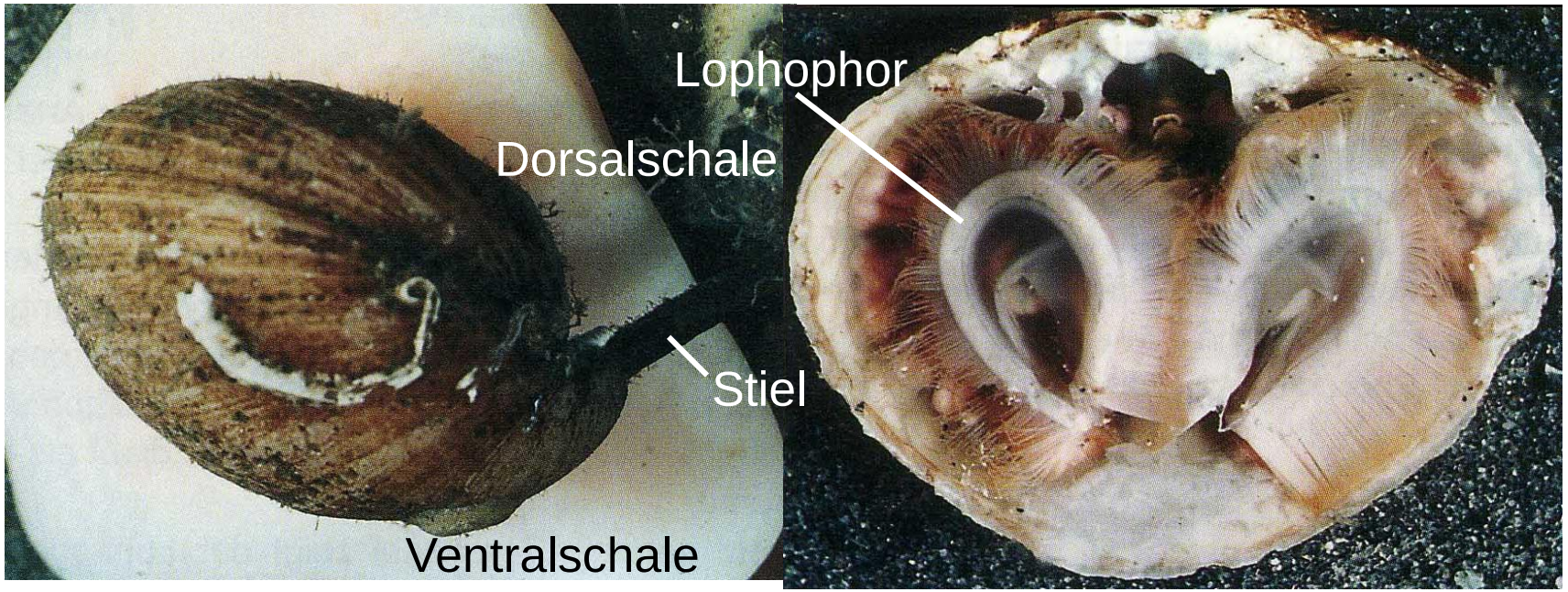
Flustra

Alcyonidium

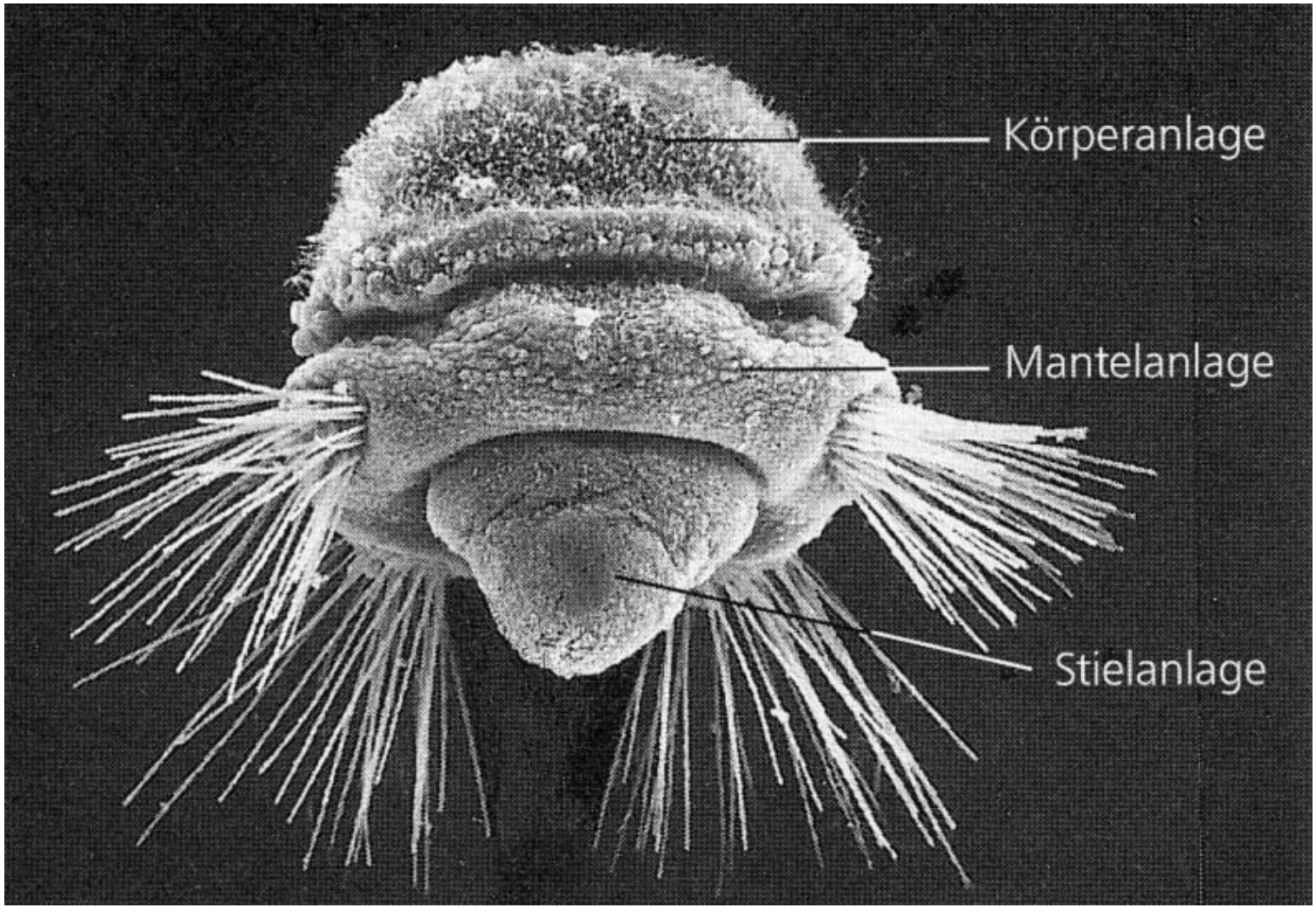
Lophophorata



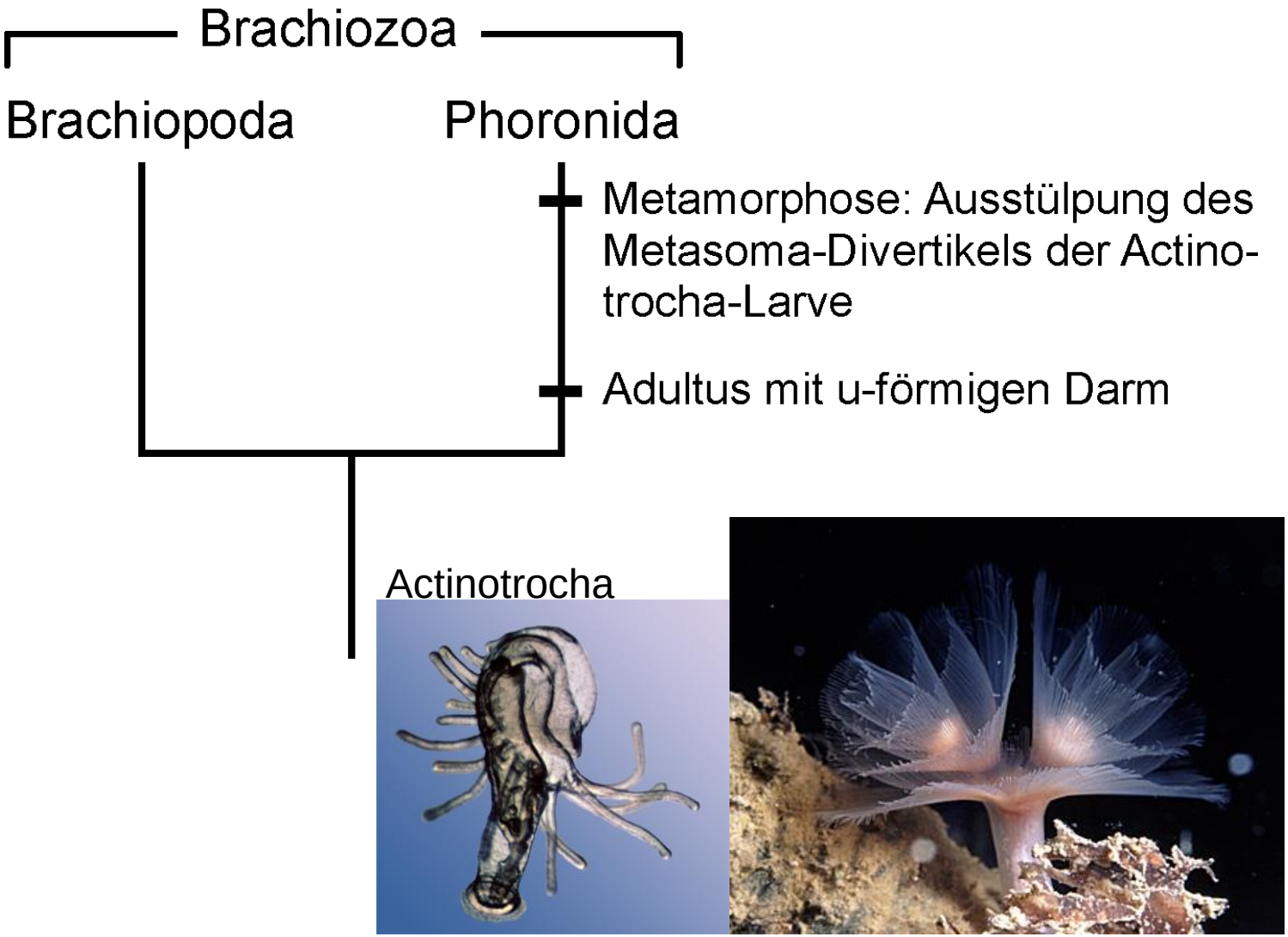
Brachiopoda (Armfüßer)



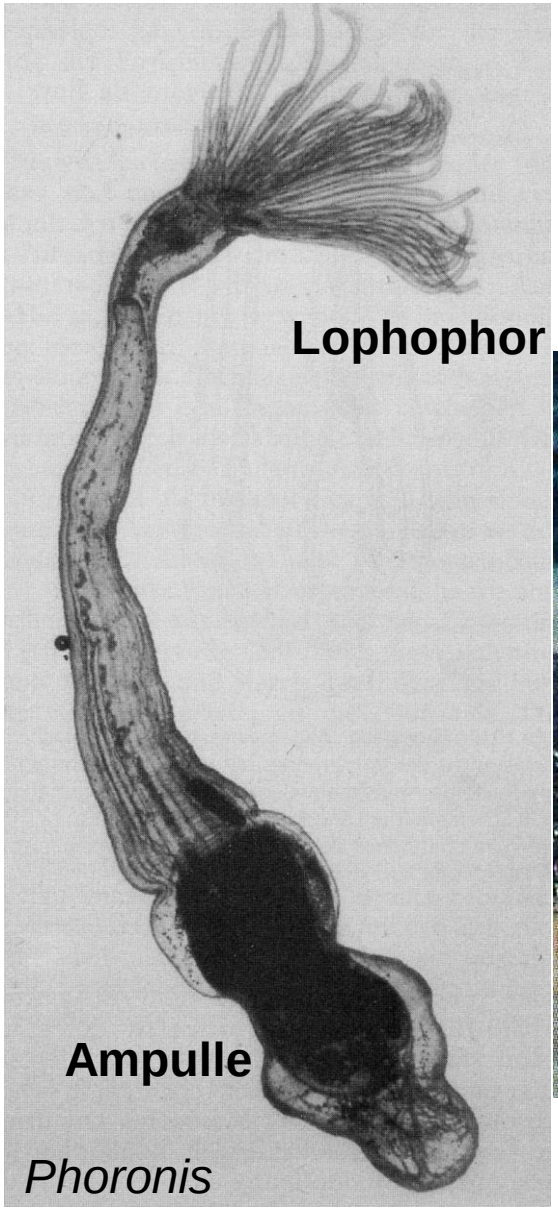
Brachiopoda (Armfüßer)



Phoronida (Hufeisenwürmer)

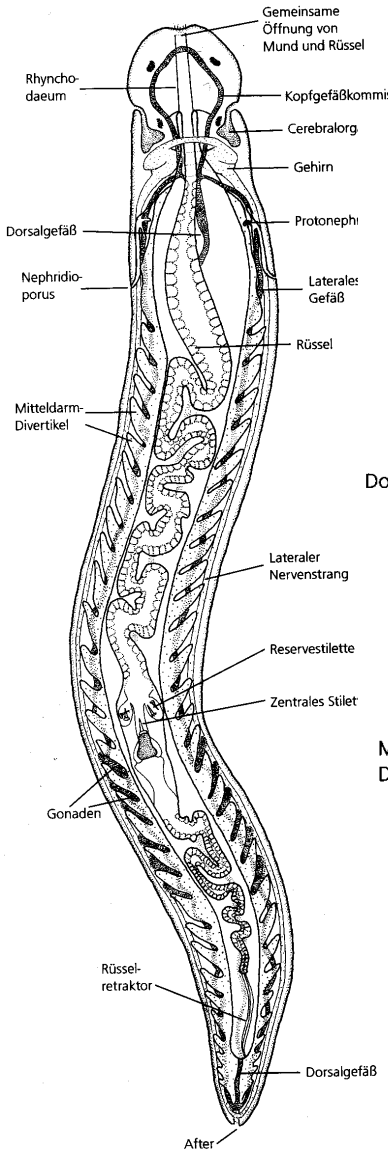


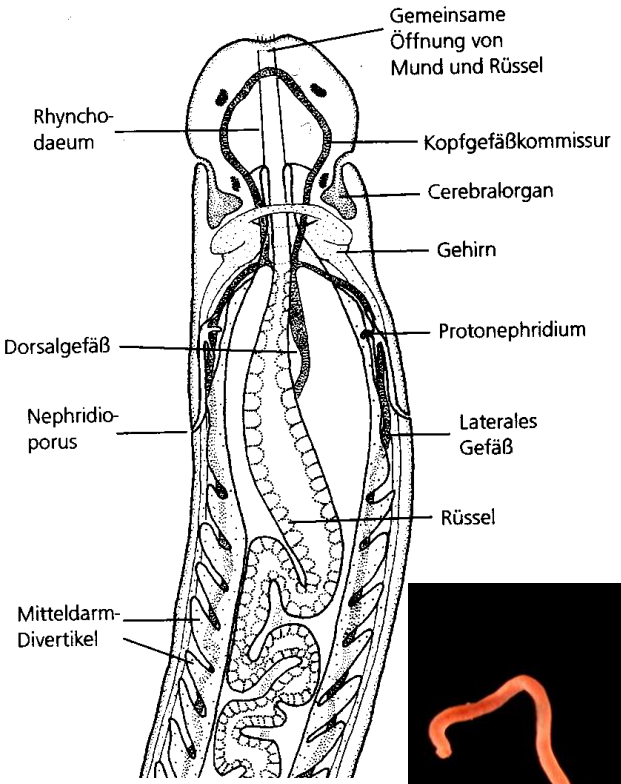
Phoronida (Hufeisenwürmer)

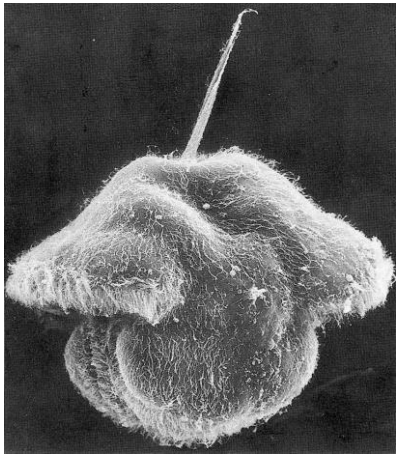


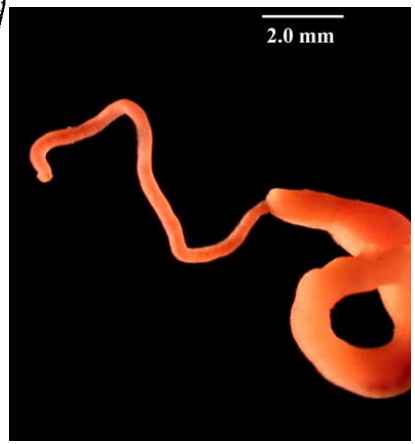
Nemertini (Schnurwürmer)

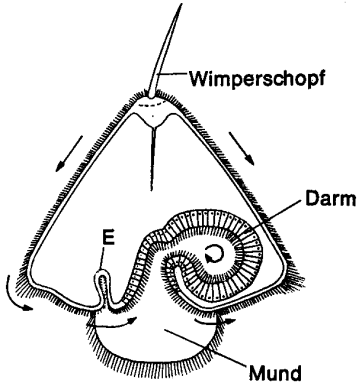
- **„*nermertes*“ – gr. Meeresnymphe**







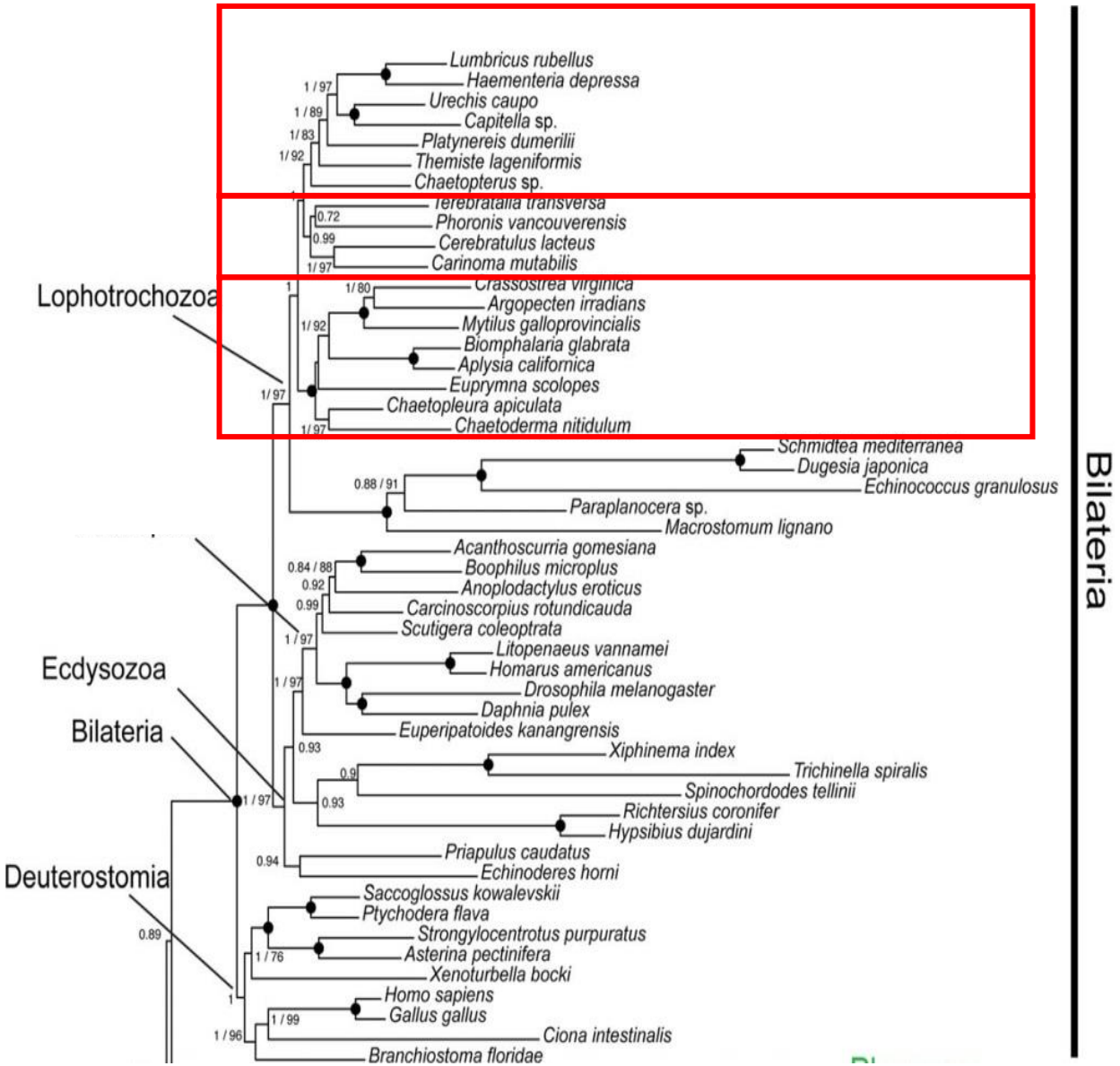




Pilidium-Larve

Stammbaum der Lophotrochozoa

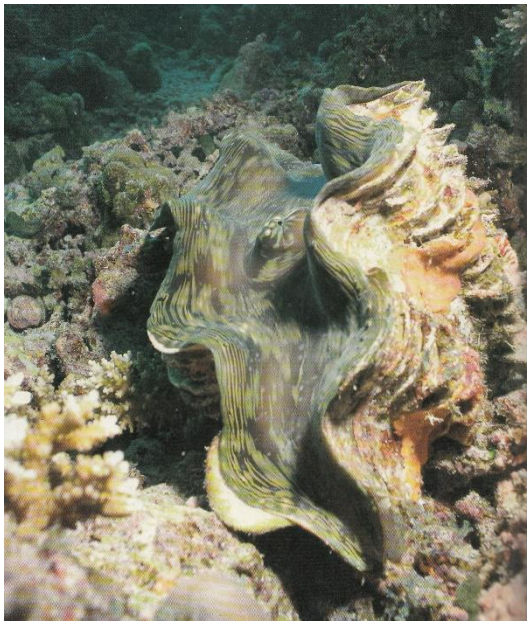
- **Annelida**
- **Tentaculata**
- **Mollusca**



Pick et al. 2010. MBE

Mollusca – Die Weichtiere

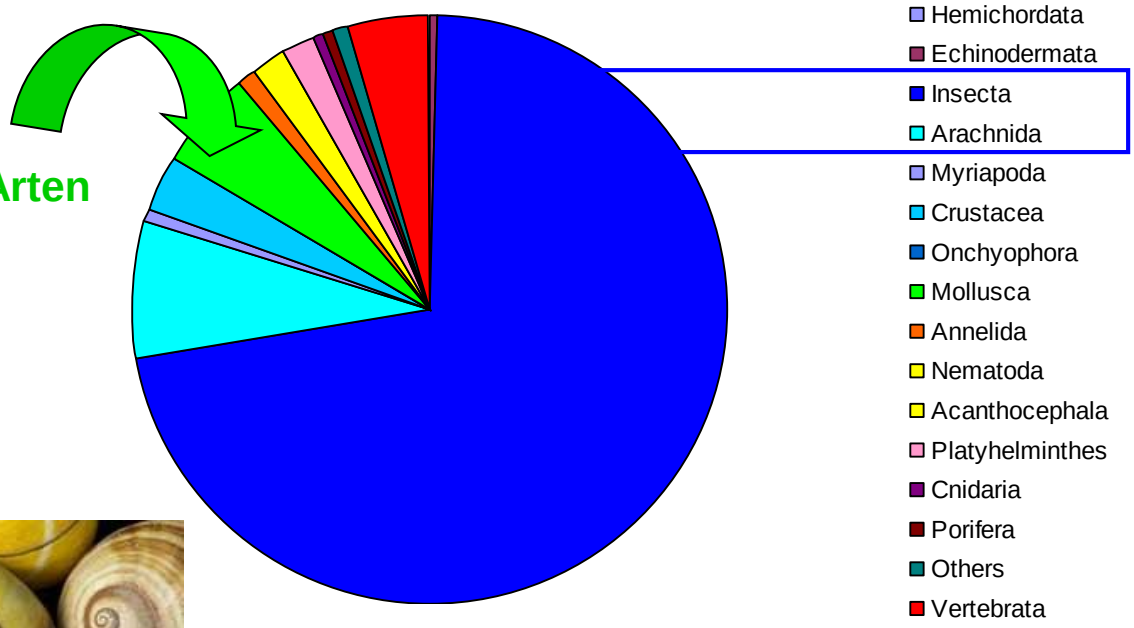
- **Harte Schale, weicher Kern - beschalte & unsegmentierte Weichtiere**



Diversität der Tiere – Das Phylum Mollusca

- **zweitgrößter Tierstamm**

Mollusca:
ca. 70.000 - 120.000 Arten

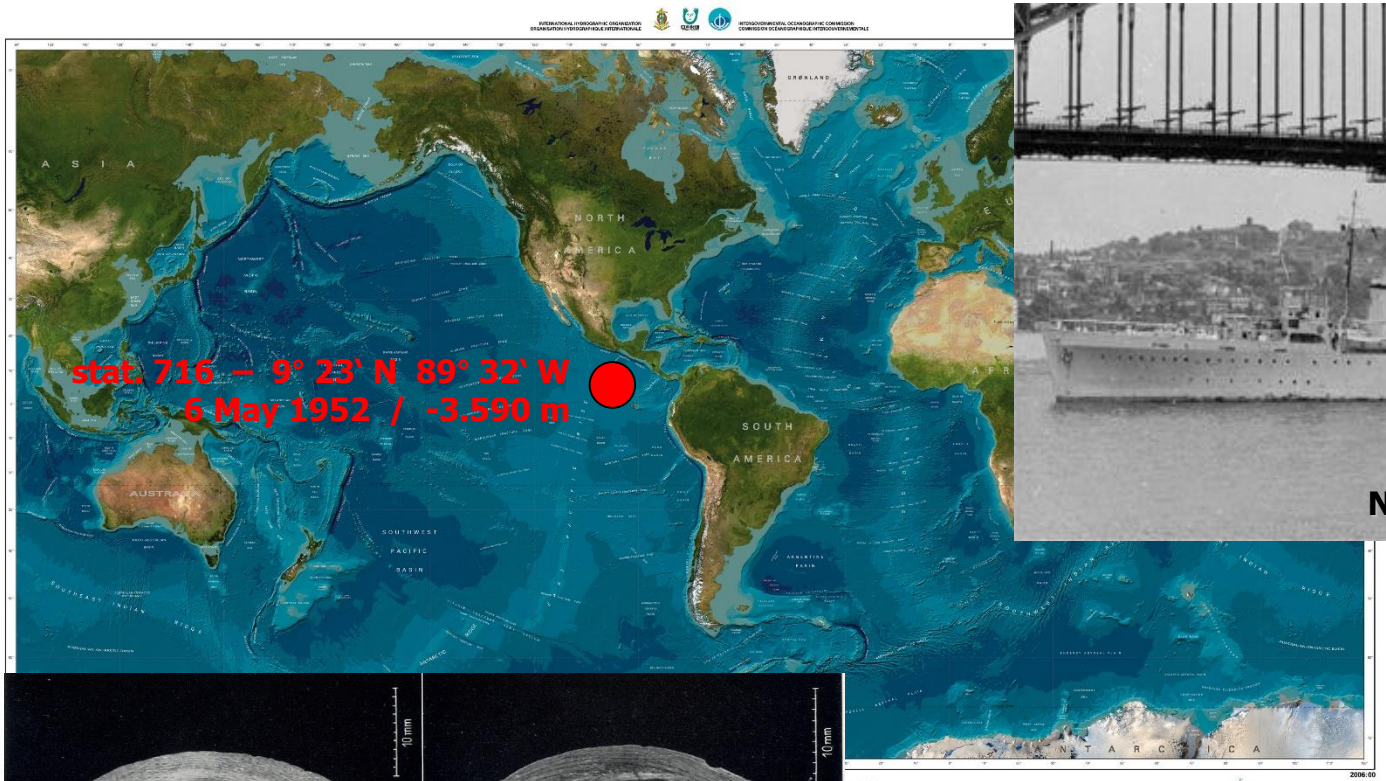


bekannte Arten einzelner Taxa

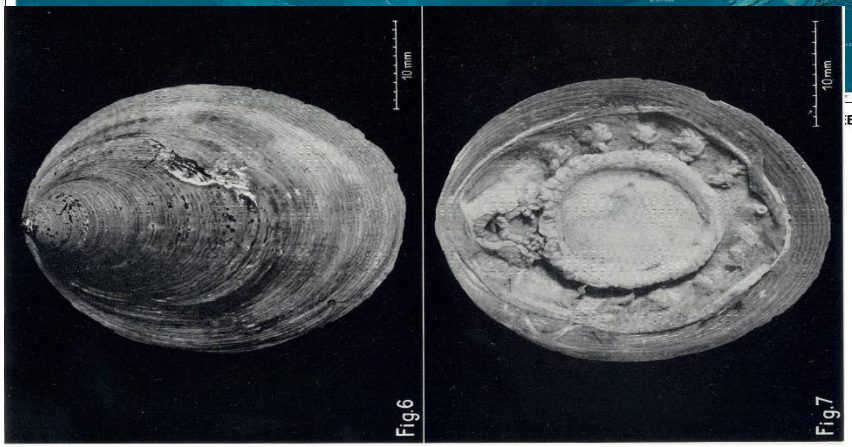
A.D.Chapman (2005) – Numbers of living species

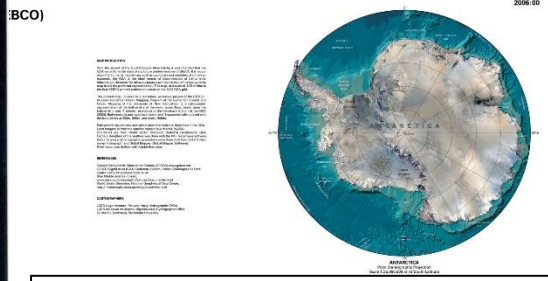
Die Entdeckung eines „lebenden Fossils“

Dänische Tiefsee - Expedition 1950-52



Navy fregate „*Galathea*"





10 Napfschnecken ähnliche Weichtiere, 3 - 4 mm

Nautiloida

Gastropoda

Phidiana, Glaucidae

Mollusca

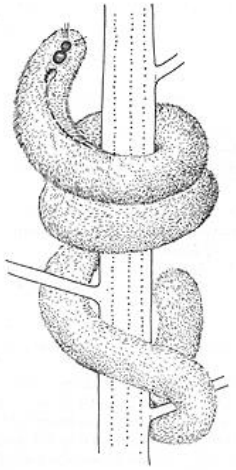
Gastropoda (Schnecken)

Cephalopoda (Kopffüsser)

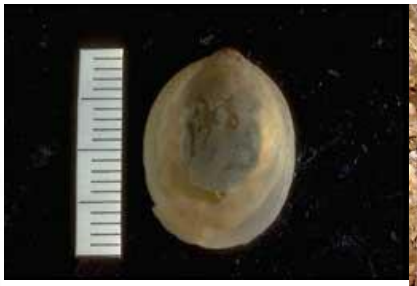
Bivalvia (Muscheln)

Scaphopoda
(Kahnfüsser)

Caudofoveata
(Schildfüsser)



Solenogastres
(Furchenfüsser)

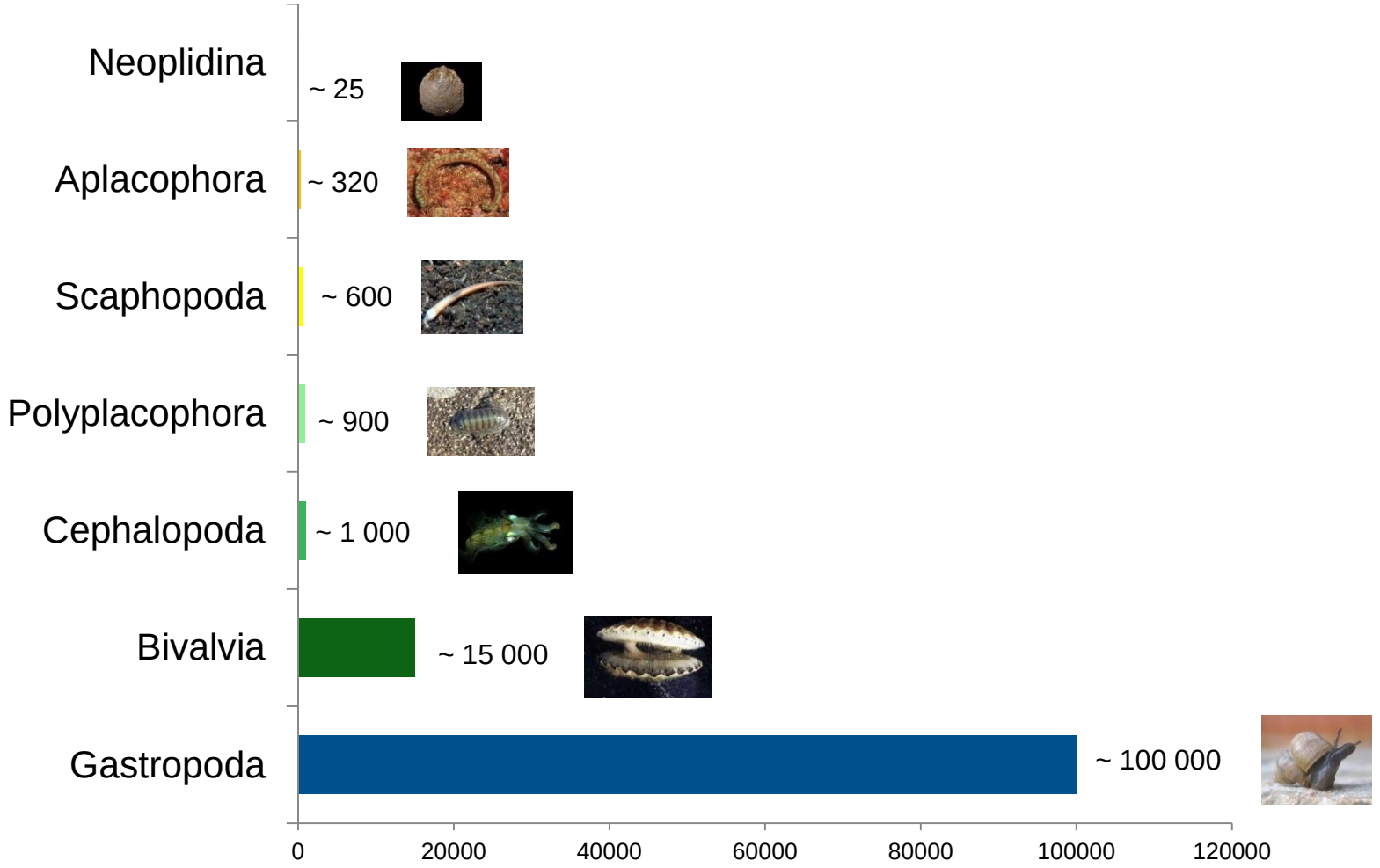


Monoplacophora
(Urmützenschnecken)

Polyplacophora
(Käferschnecken)

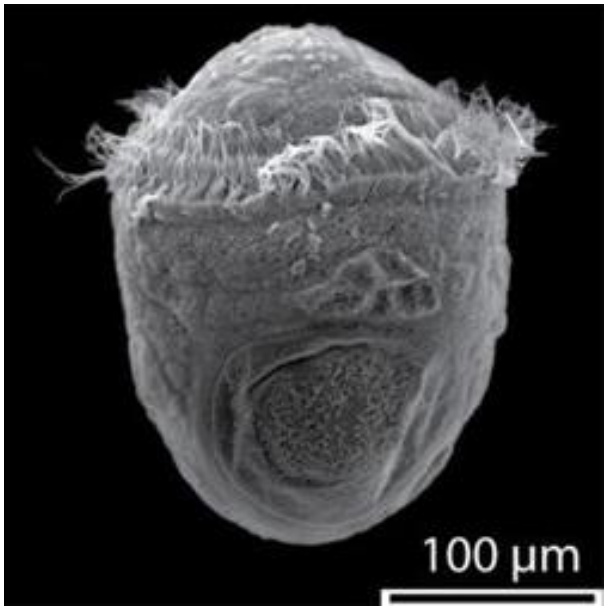
Mollusca

- **Biodiversitätsverteilung innerhalb der Mollusca**



Mollusca

- **Larventypen der Mollusken**



Trochophora

Veliger

Anatomie eines Mollusken

- **alternative Art der Fortbewegung – Fuß als Lokomotionsorgan**

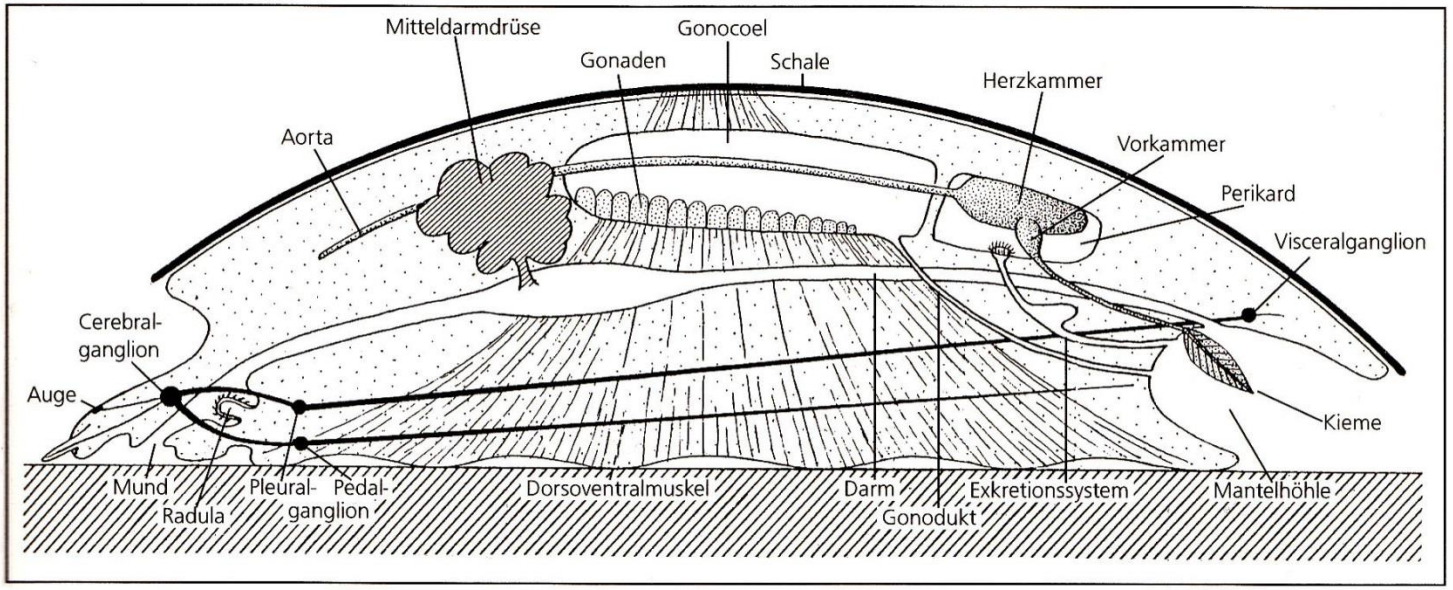


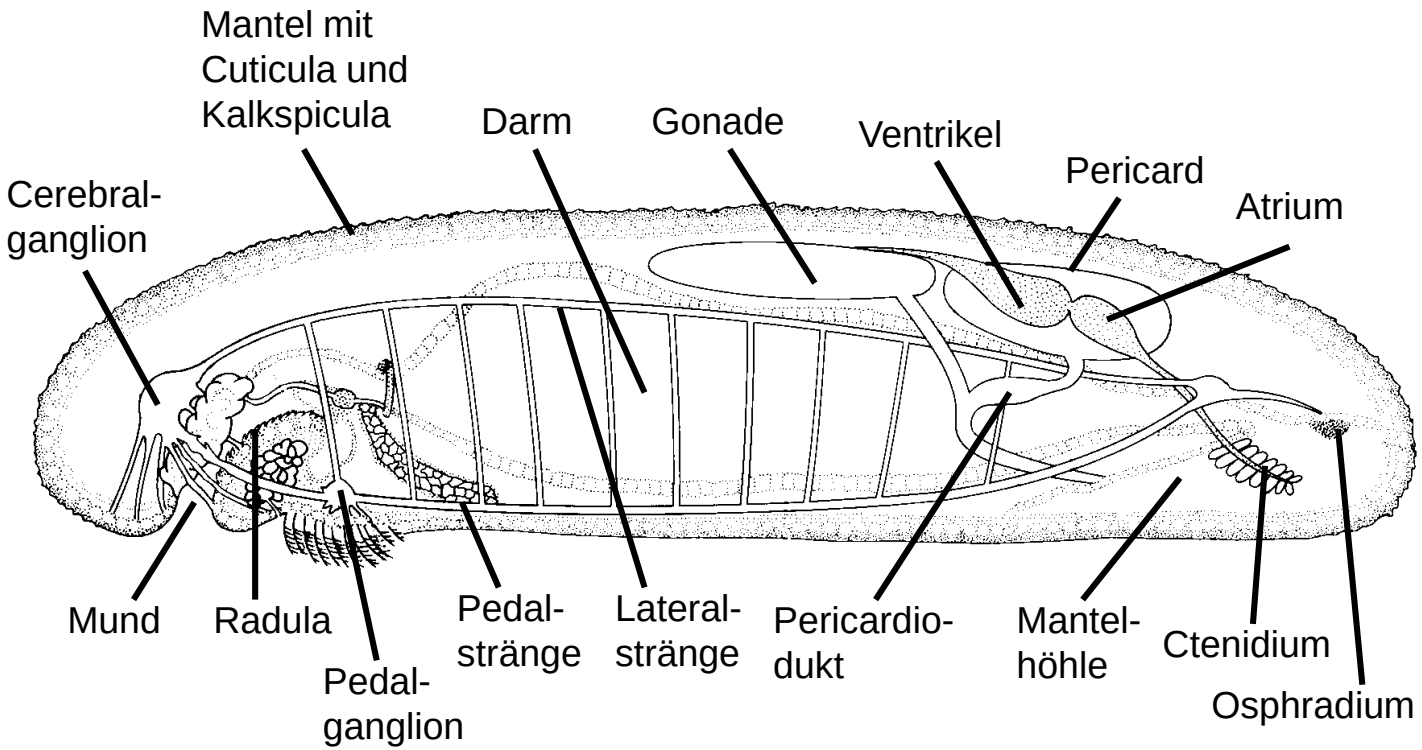
Abb. 386: Organisationsschema eines beschalten Mollusken. Verändert nach Götting (1974).

- **ventrale Muskulatur des Hautmuskelschlauchs ausgeprägt**

- **Wegfall eines als Hydroskelett wirkenden Coeloms (wie z.B. bei Anneliden)**

Mollusca

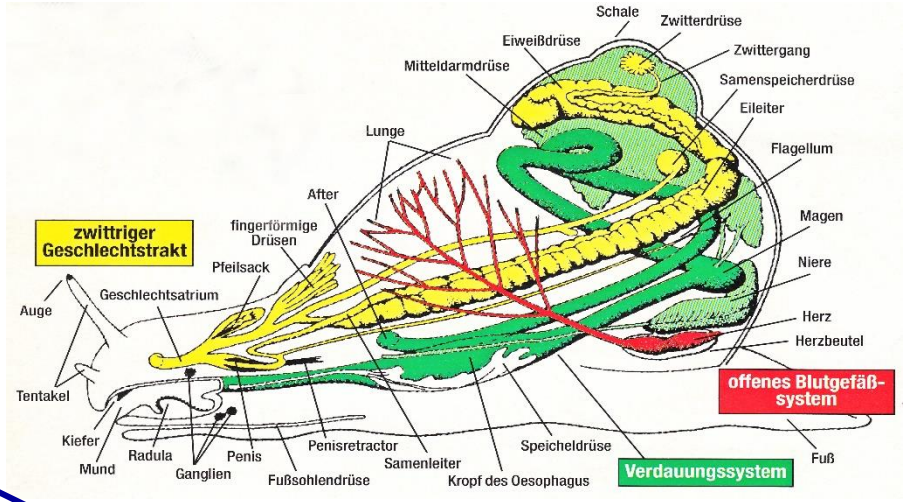
- **Schema der Stammart der Mollusken**



Anatomie eines Mollusken

- **dreiteilige Architektur des Körpers:**

  Kopf – Fuß – EGS



Visceropallium

- **Eingeweidesack** mit inneren Organen

  allometrisches Wachstum der Rückenseite

Cephalopodium

- **Kopf** - Raspelorgan (Radula)
- **Fuß** - Kriechen, Graben, Schwimmen

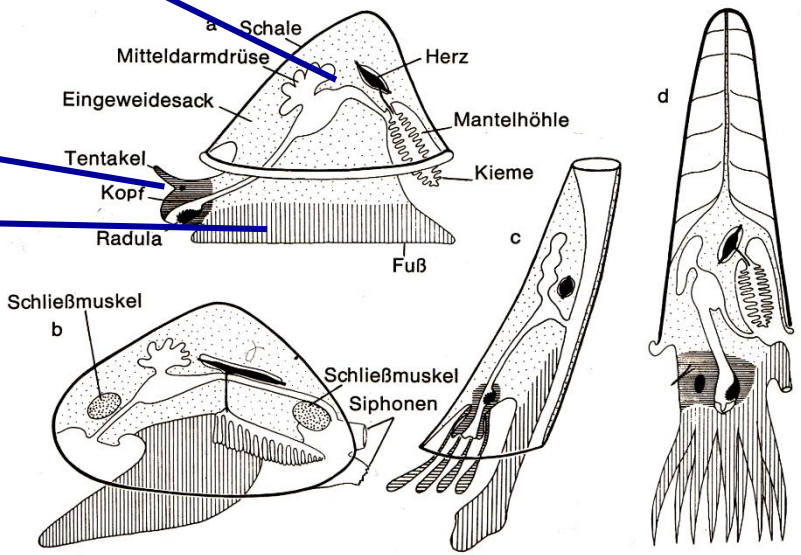
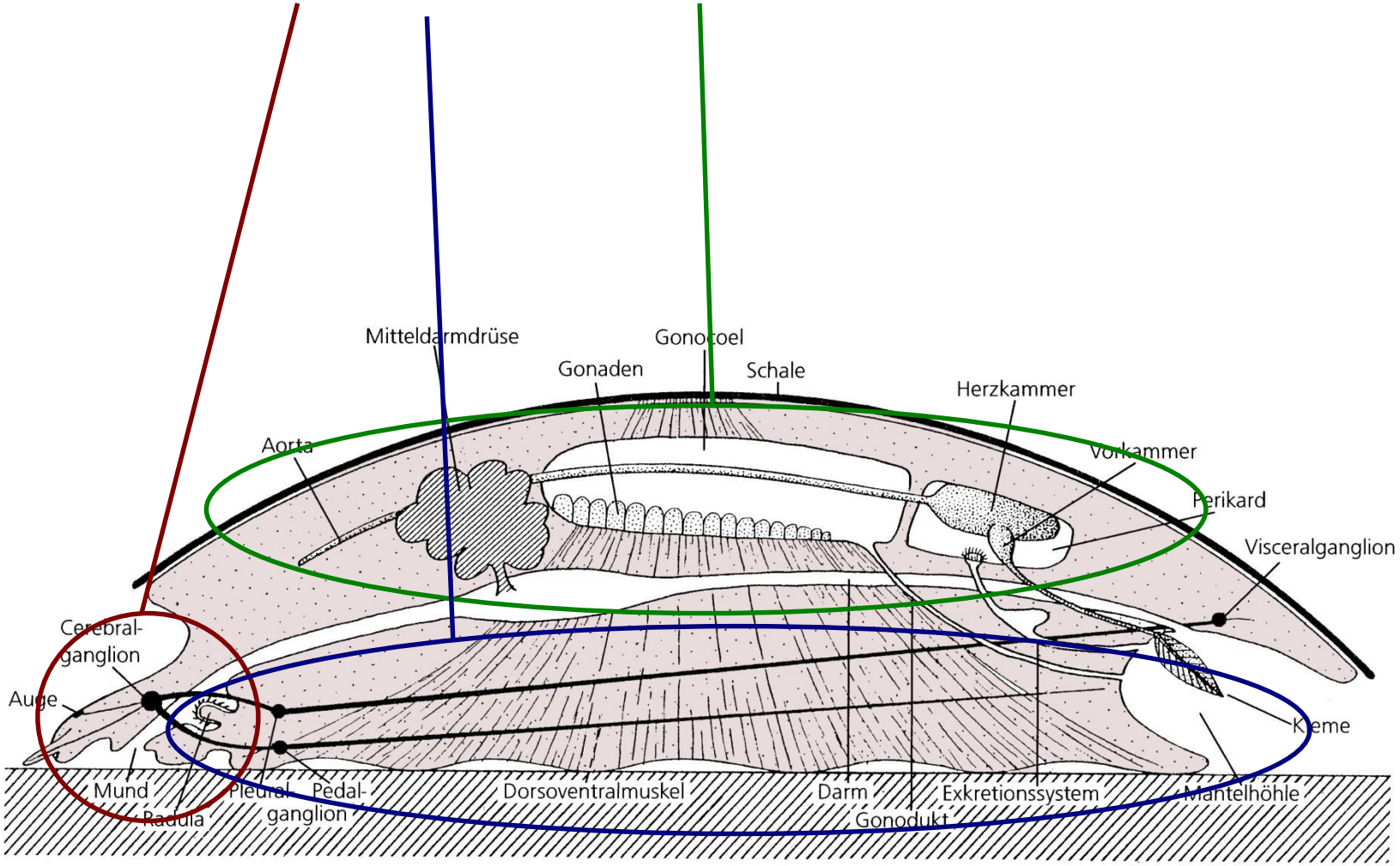


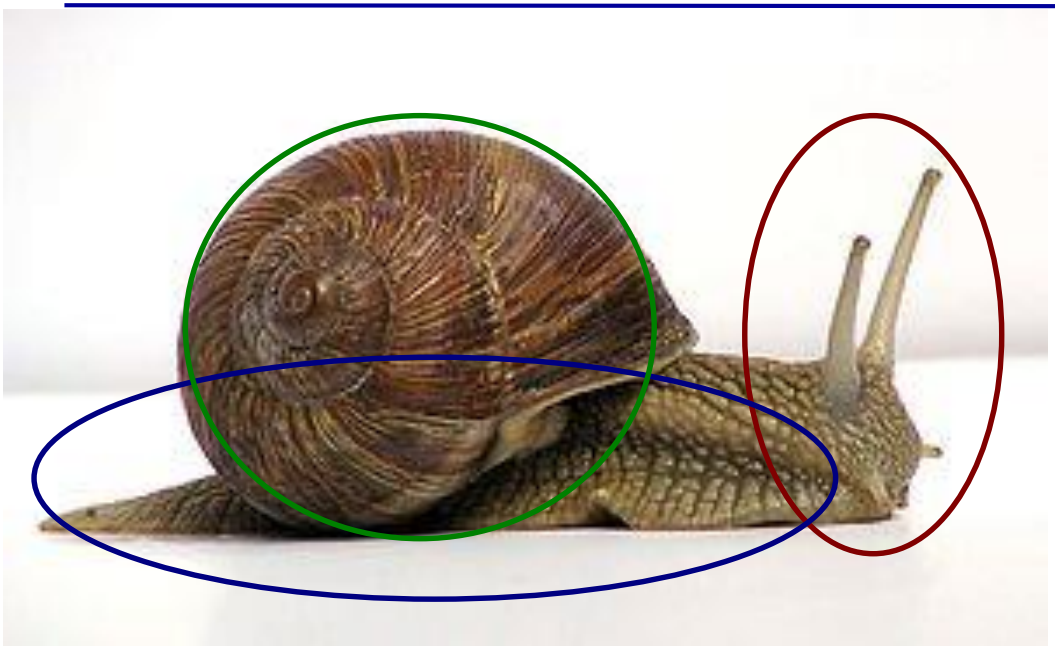
Abb. 102: Conchiferen-Baupläne. a. Ausgangsform mit besonders engen Beziehungen zu den Gastropoden. b. Muschel, c. Scaphopode, d. Cephalopode. Nach Remane, Storch, Welsch

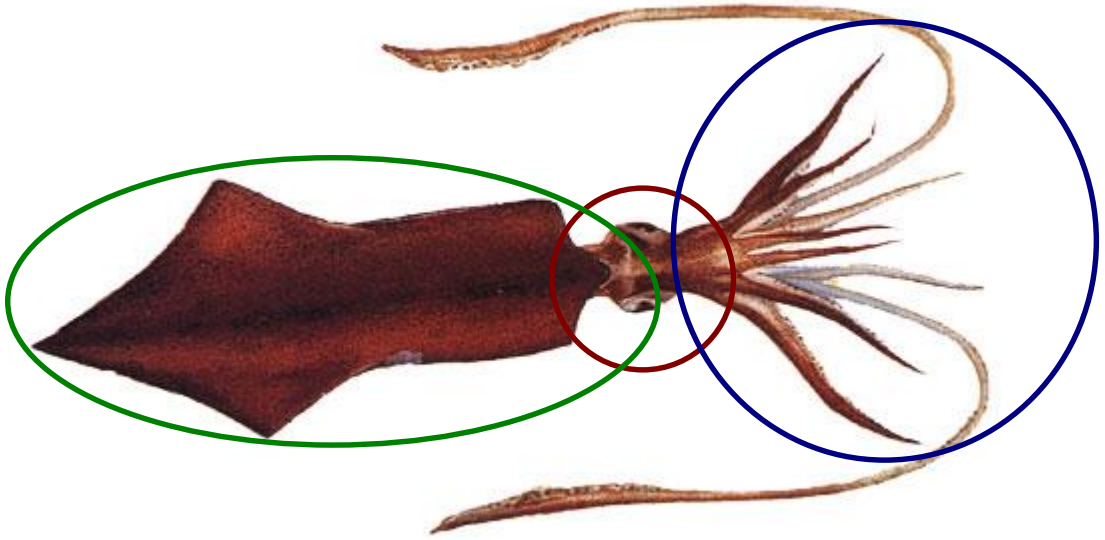
Mollusca

Gliederung in Kopf, Fuß und Eingeweidesack



Mollusca





Anatomie der Mollusken

- **ähnlich Körperorganisation**
  - **Gastropoda**
  - **Bivalvia**
  - **Cephalopoda**

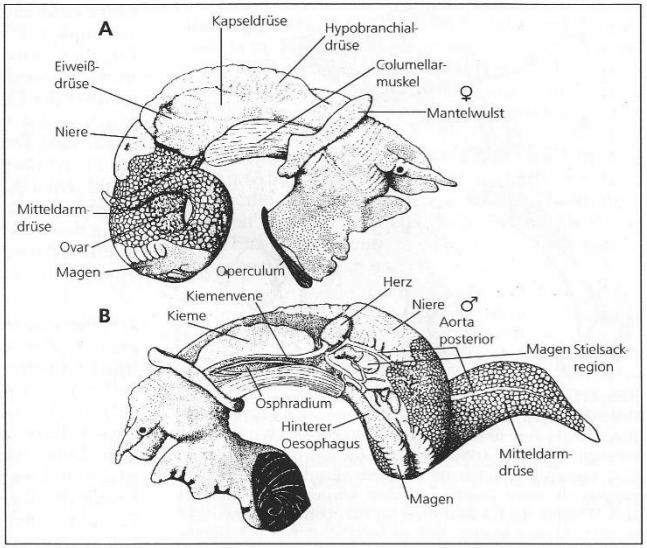


Abb. 410: Strandschnecke (*Littorina littorea*). A Weibchen von rechts. B Männchen von links. Mantelgewebe durchscheinend, so daß die Anordnung der inneren Organe sichtbar wird. Verändert nach Fretter und Graham (1962).

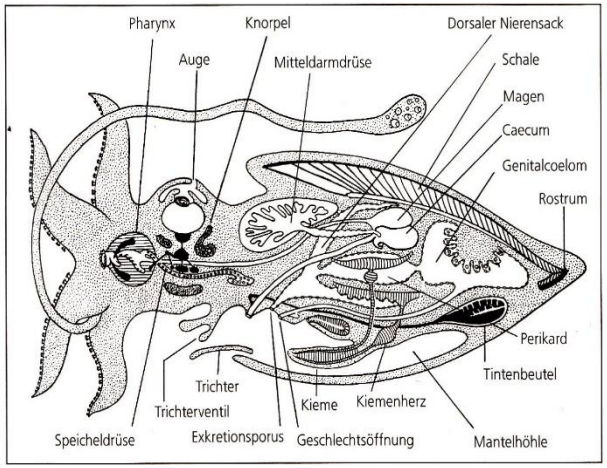


Abb. 441: Coleoida (*Sepia officinalis*). Schema der Organisation im Längsschnitt. Das linke Auge ist um ca. 90° nach oben gedreht; wichtigste Blutbahnen schraffiert, Coelom und Nieren weiß mit schematisiertem Wandepithel. Nach Stempell (1929) aus Kaestner (1969).

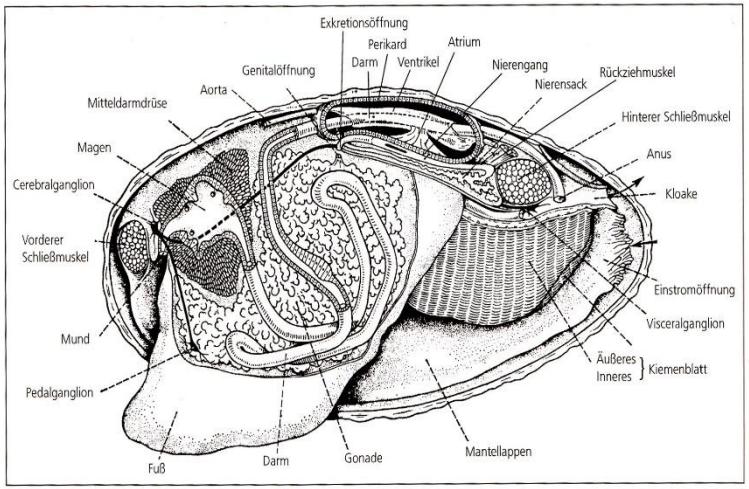
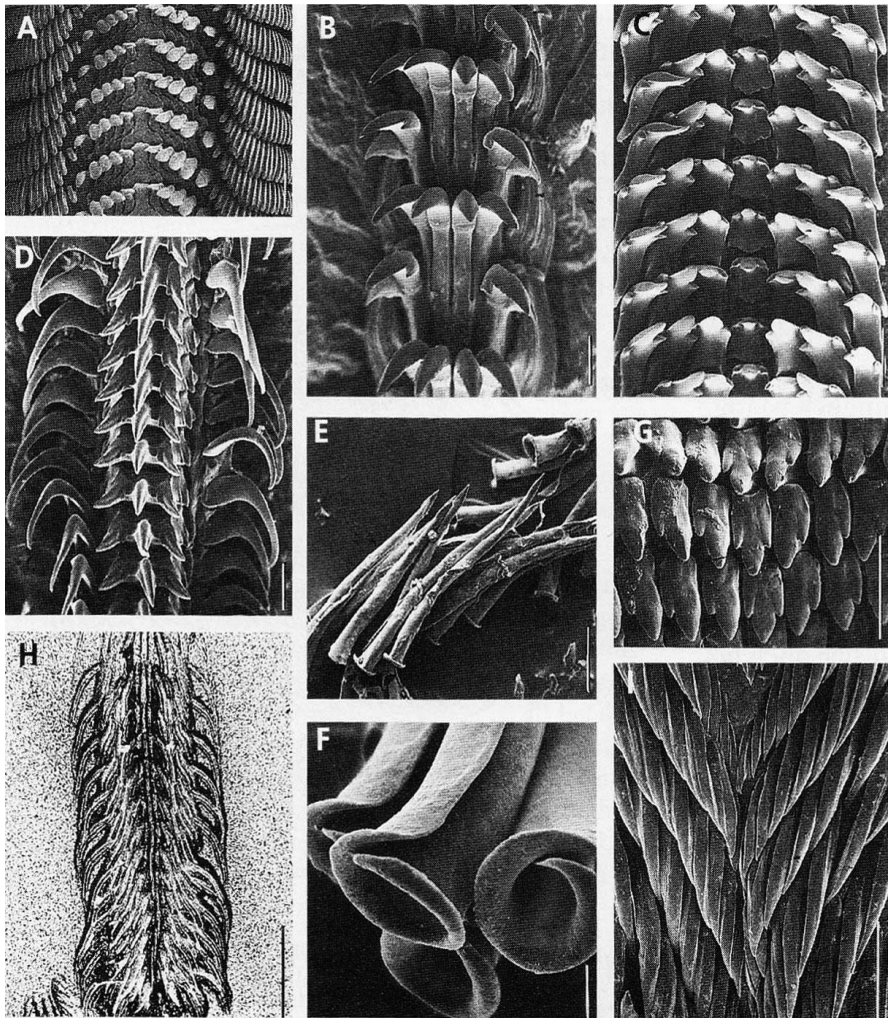


Abb. 451: Bivalvia. Schema der inneren Organisation (*Anodonta cygnea*). Rechte Klappe und rechter Mantellappen entfernt; Weichkörper median durchschnitten. Verändert nach Kükenthal, Matthes und Renner (1967).

Schlüsselmerkmal der Weichtiere

- **das Raspelorgan – die Radula**



"Zeig' mir deine Zunge …

… und ich sag' dir, wer du bist."

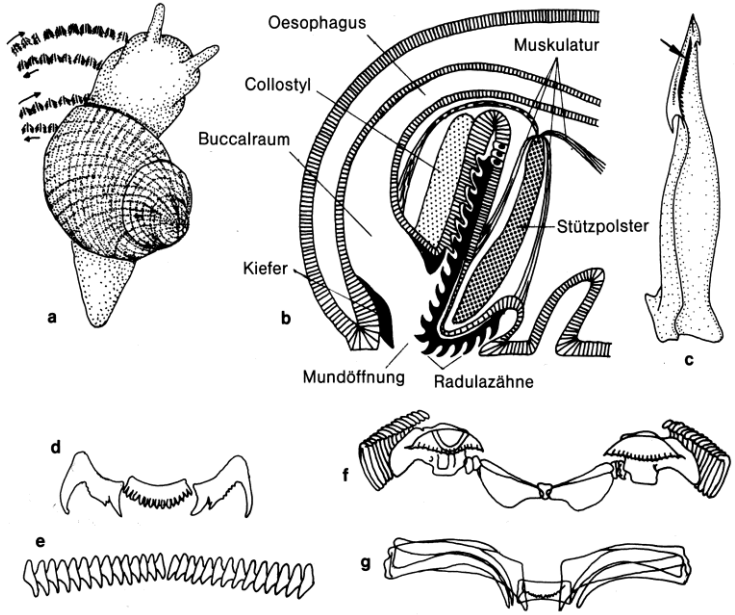
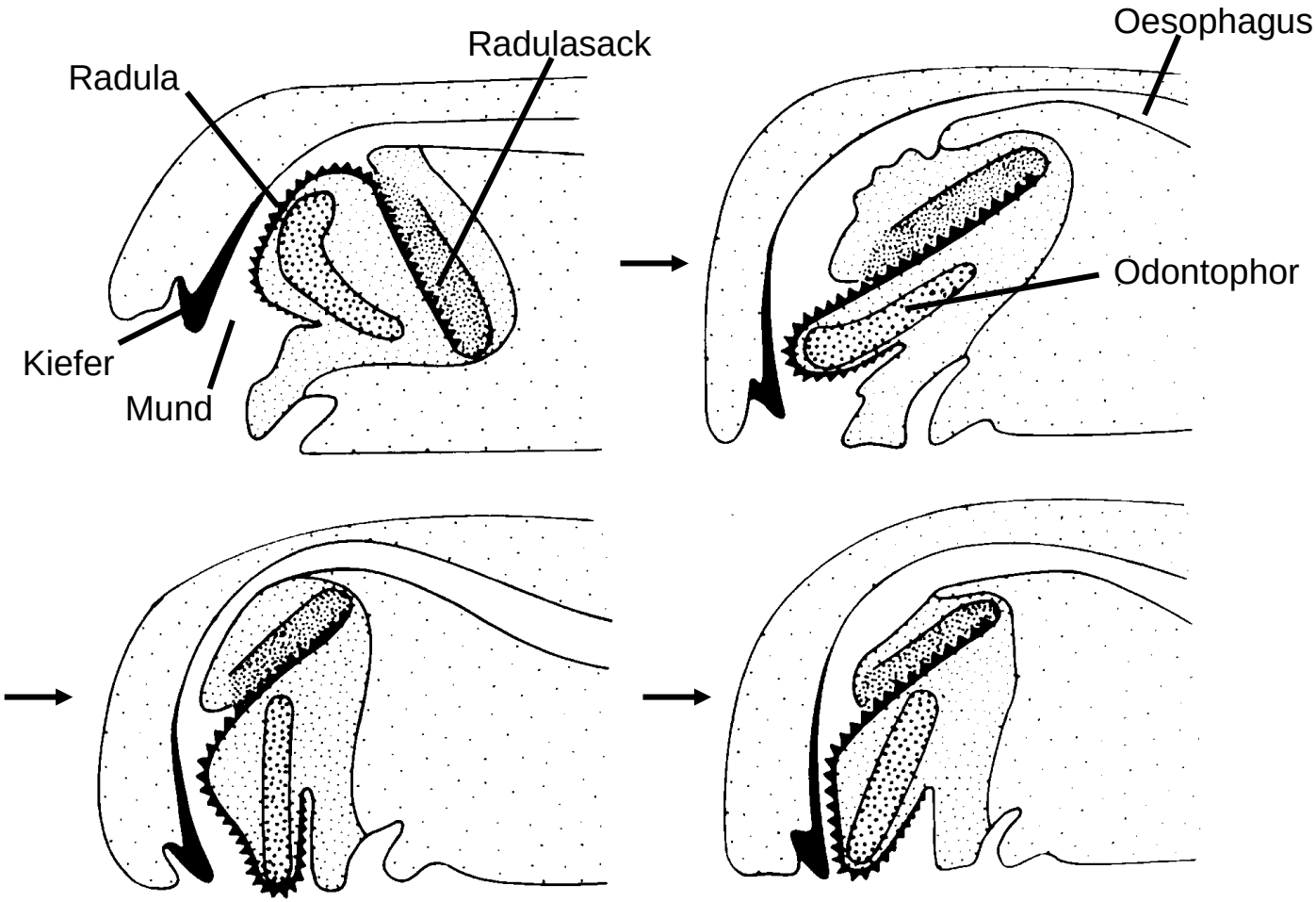


Abb. 108: Radula. a. *Littorina* beim Abweiden des Substrates. Beim langsamen Vorwärtsgleiten wird der Kopf pendelnd bewegt (Pfeile, «Pendelfraß»). Die Tätigkeit der Radula hinterläßt Bißspuren. b. Schema des Radulaapparates einer Lungenschnecke (Sagittalschnitt, Funktionsstellung der Radula); das Collostyl ist eine Stützstruktur aus Muskel- und Bindegewebe, die von Bluträumen durchzogen wird. c–g. Radulazähne. c. einzelner Zahn einer toxoglossen Radula *(Conus)*, die bei vielen Neogastropoden vorkommt. Der Pfeil weist auf den Giftentleerungsspalt. d. Neben dem Zentralzahn steht jederseits ein Lateralzahn. e. Zahnreihe einer ptenoglossen Radula *(Scalaria)* aus zahlreichen, gleichartigen Zähnen; ein Zentralzahn fehlt. f. Zahnreihe einer rhipidoglossen Radula *(Neritina)*: neben dem Zentralzahn 2 Typen anderer Zähne (laterale und marginale Zähne). g. Zahnreihe aus taenioglosser Radula *(Pterotrachea)* mit Zentralzahn und jederseits wenigen lateralen und marginalen Zähnen. Kommt bei den meisten Mesogastropoden vor. Nach Kerth, Kolm, Loren, MacDonald, Nybakken, van Mol, Wägele

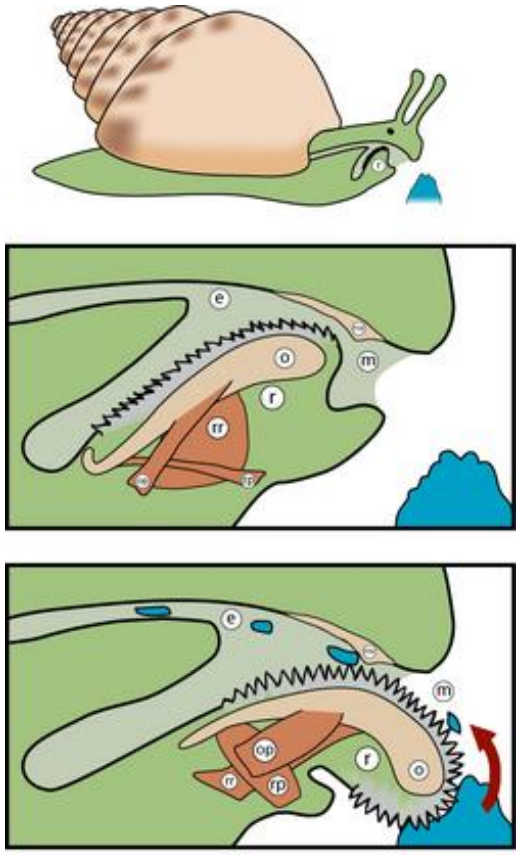
Mollusca

- **Bau und Funktion des Radula-Apparates**

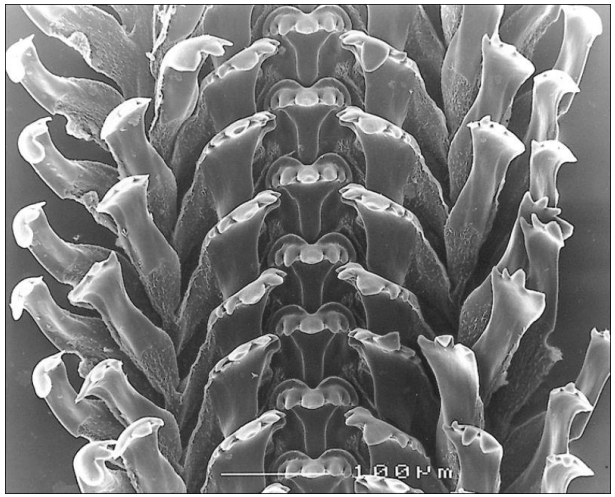


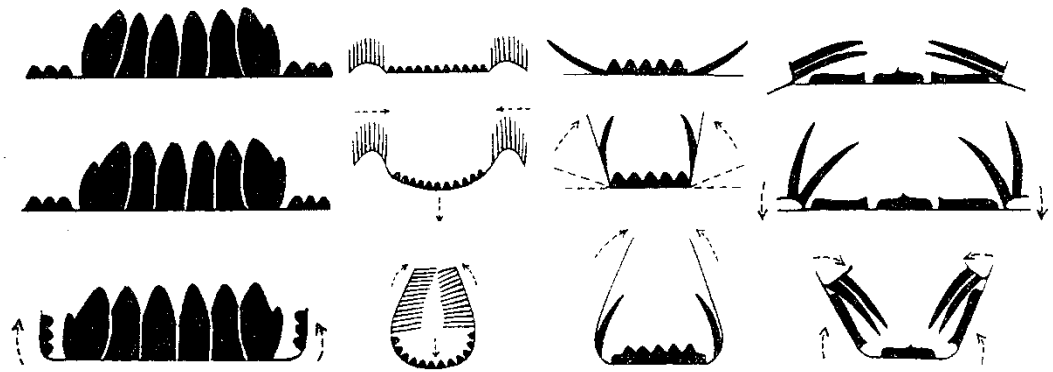
Mollusca

- **Radula (Raspelorgan) – fehlt nur bei den Muscheln**



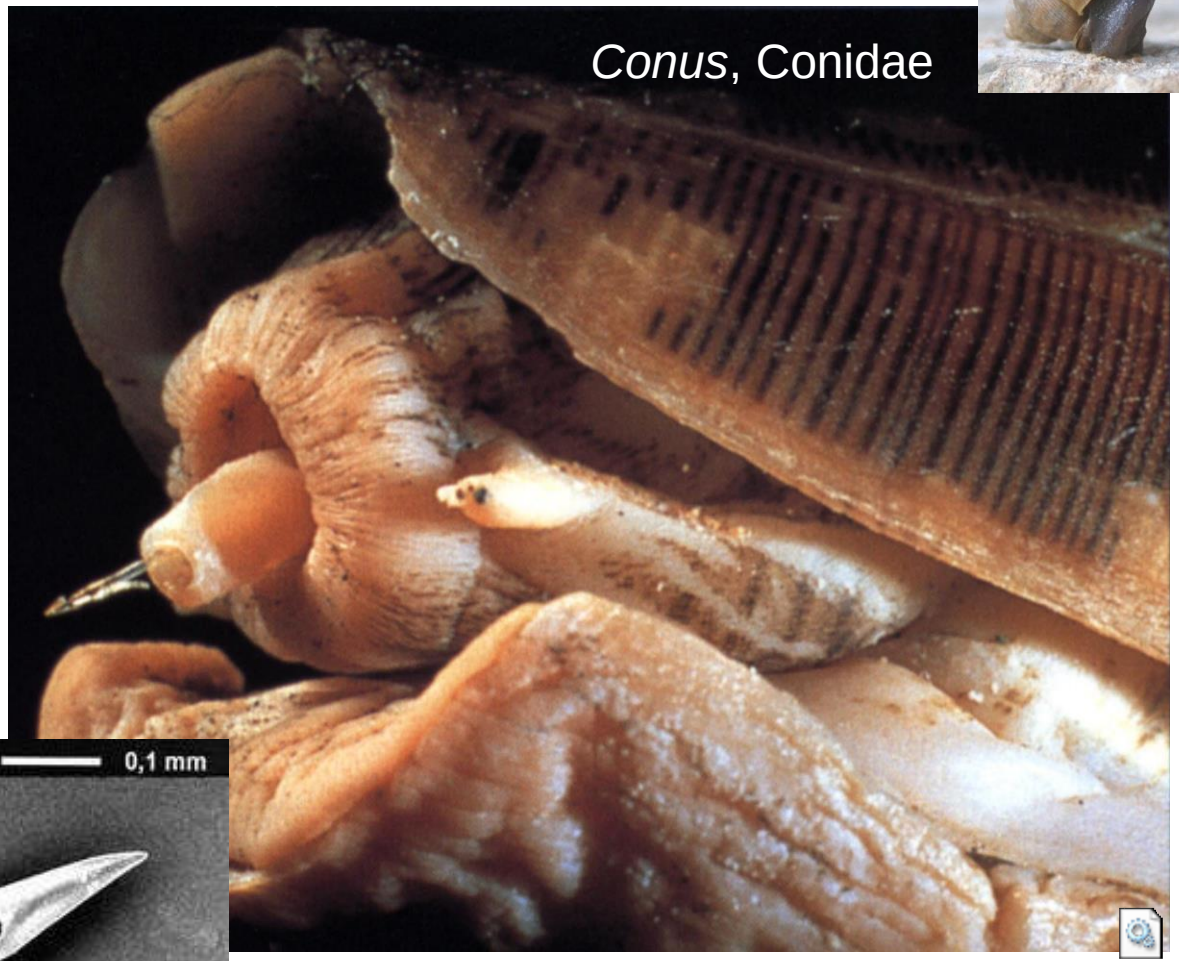
e = esophagus
m = mouth
mx = maxilla
o = odontophore
op = odontophore protractor muscle
r = radula
rp = radula protractor muscle
rr = radula retractor musle



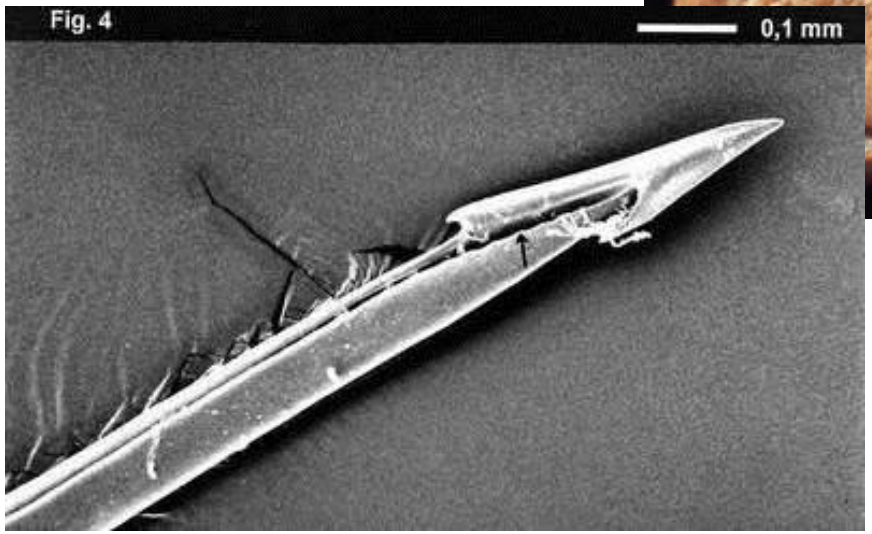


Mollusca

Conus, Conidae

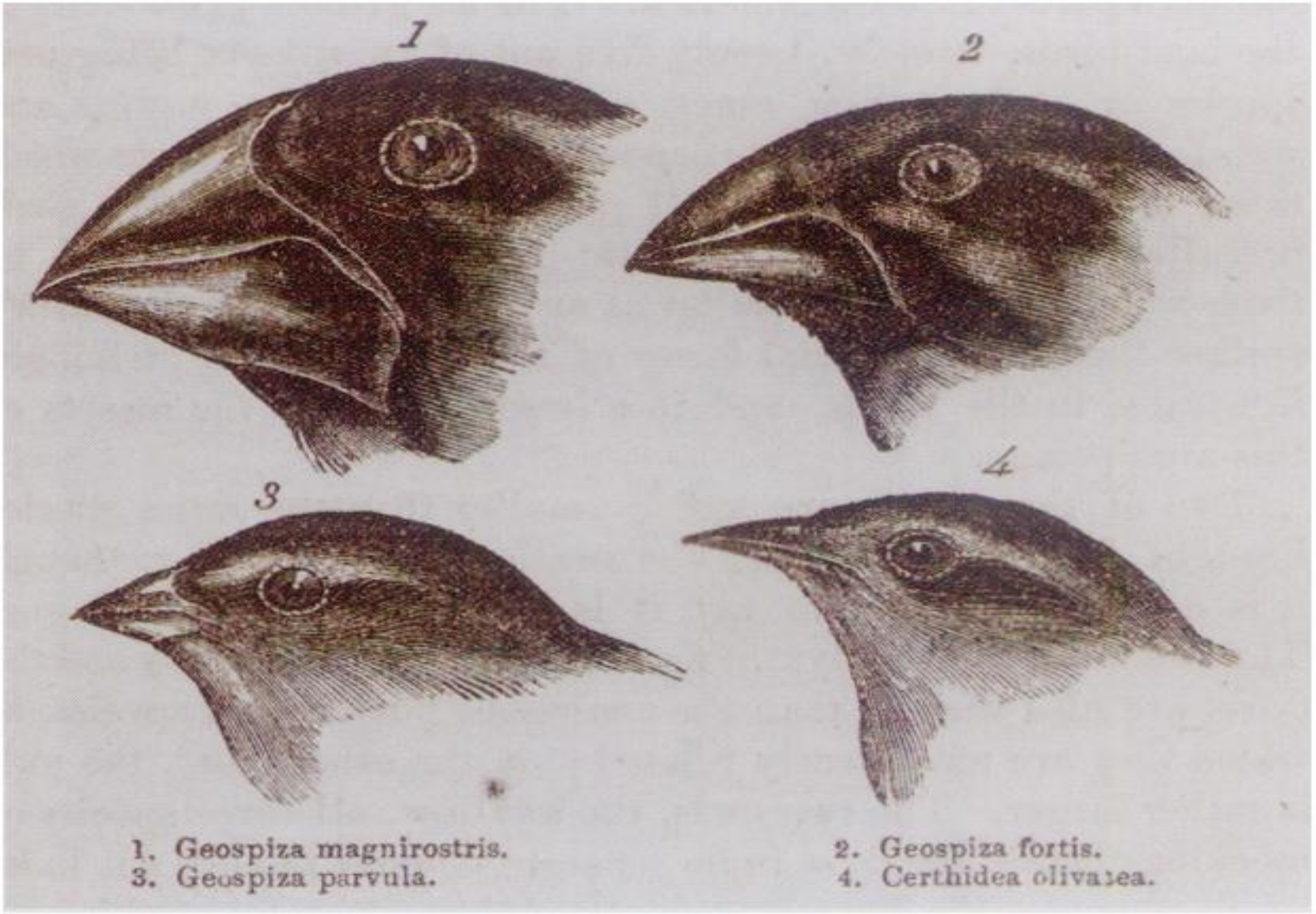


Conus1.mov



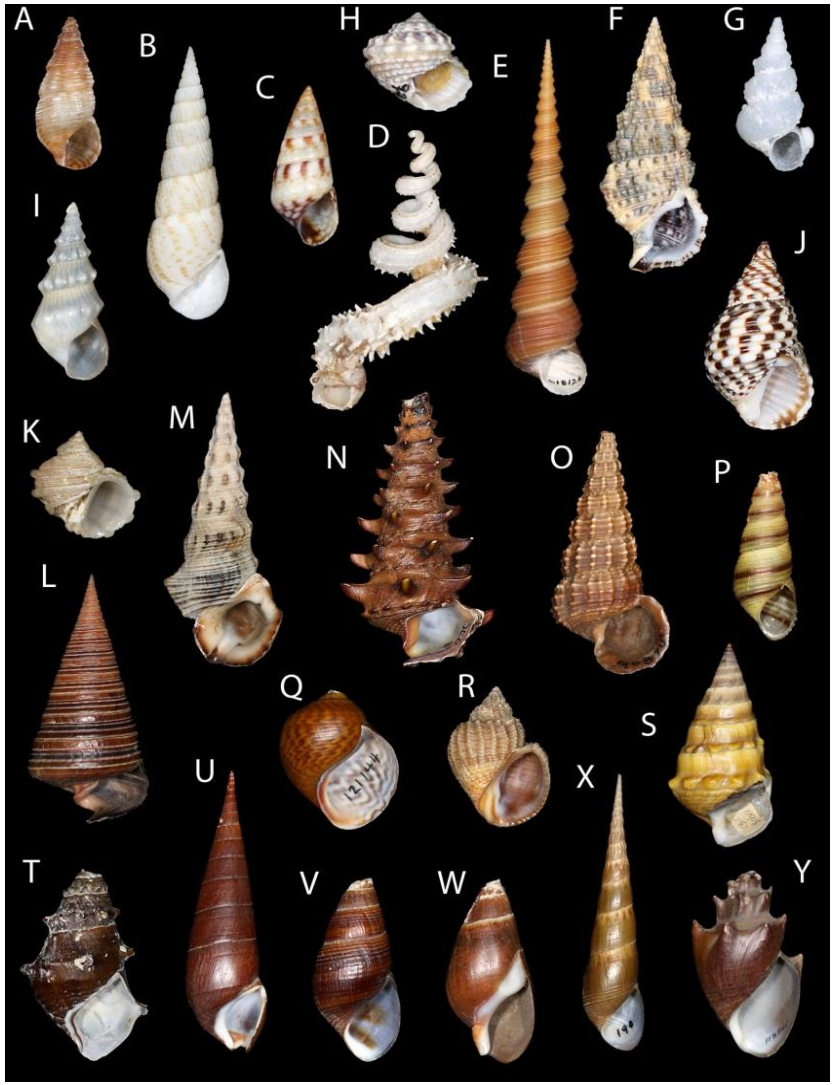
Mollusca

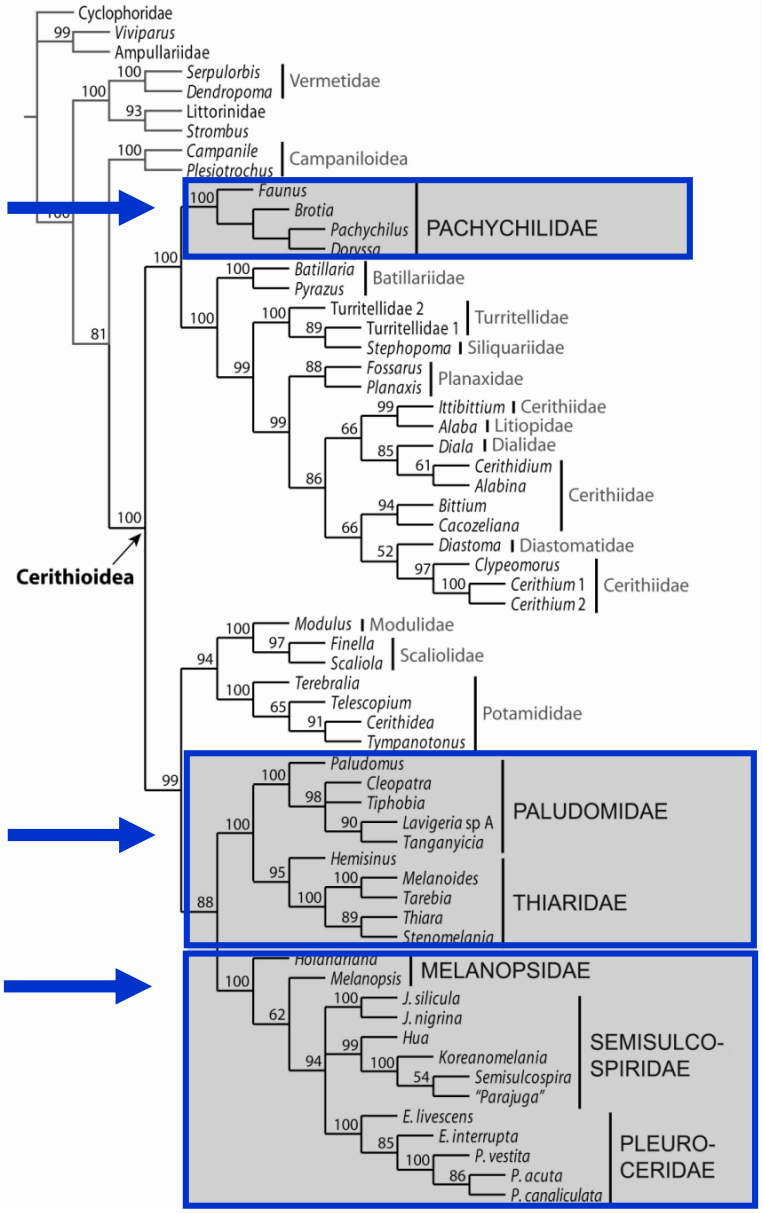
- **Radula-Typen**



Cerithioidea – or The invasion of freshwater

- **The phylogenetic framework using cladistics**

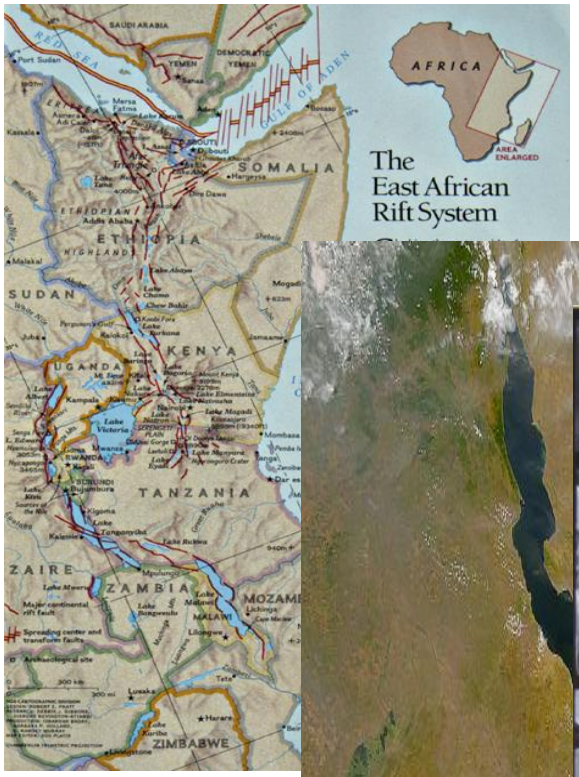


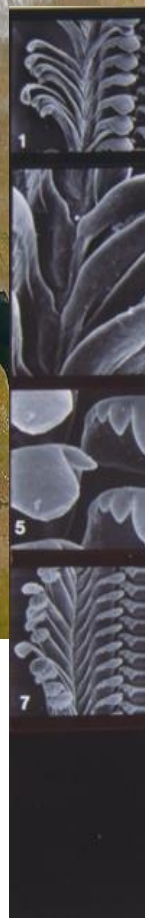


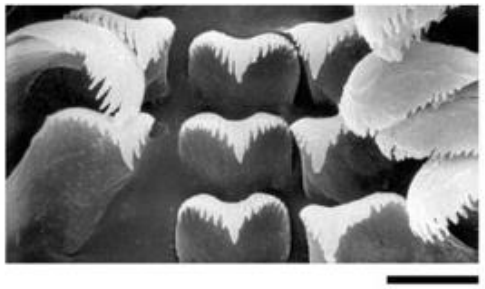
Strong et al. (2010) – Zool. J. Linn. Soc.

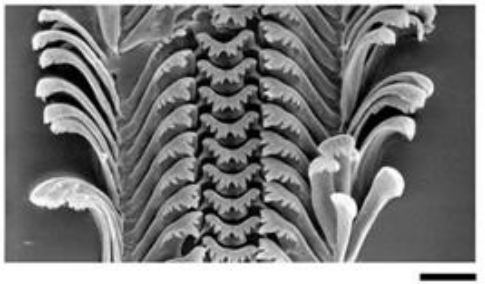
The „lost world" of Lake Ta

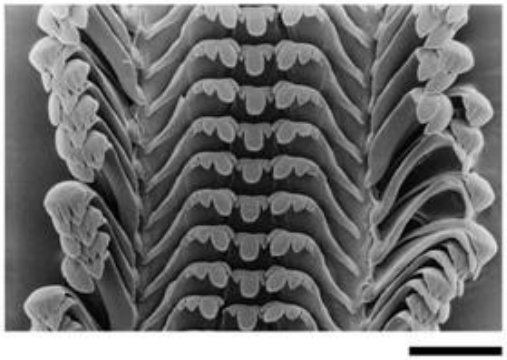
thalassoid

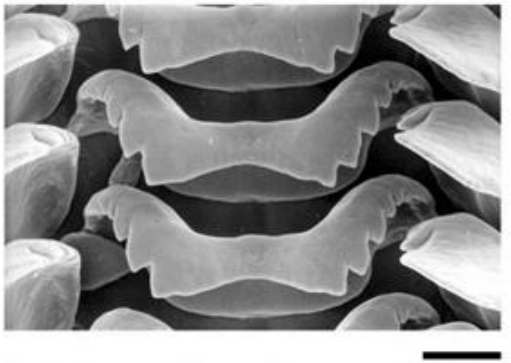


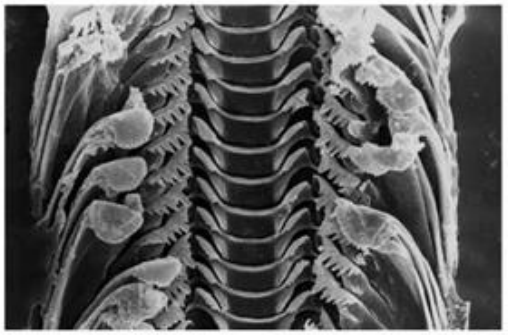


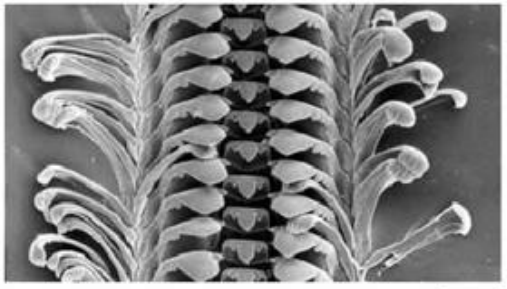


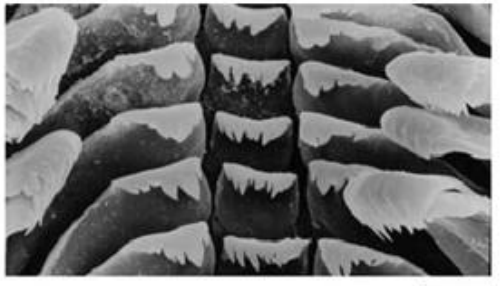








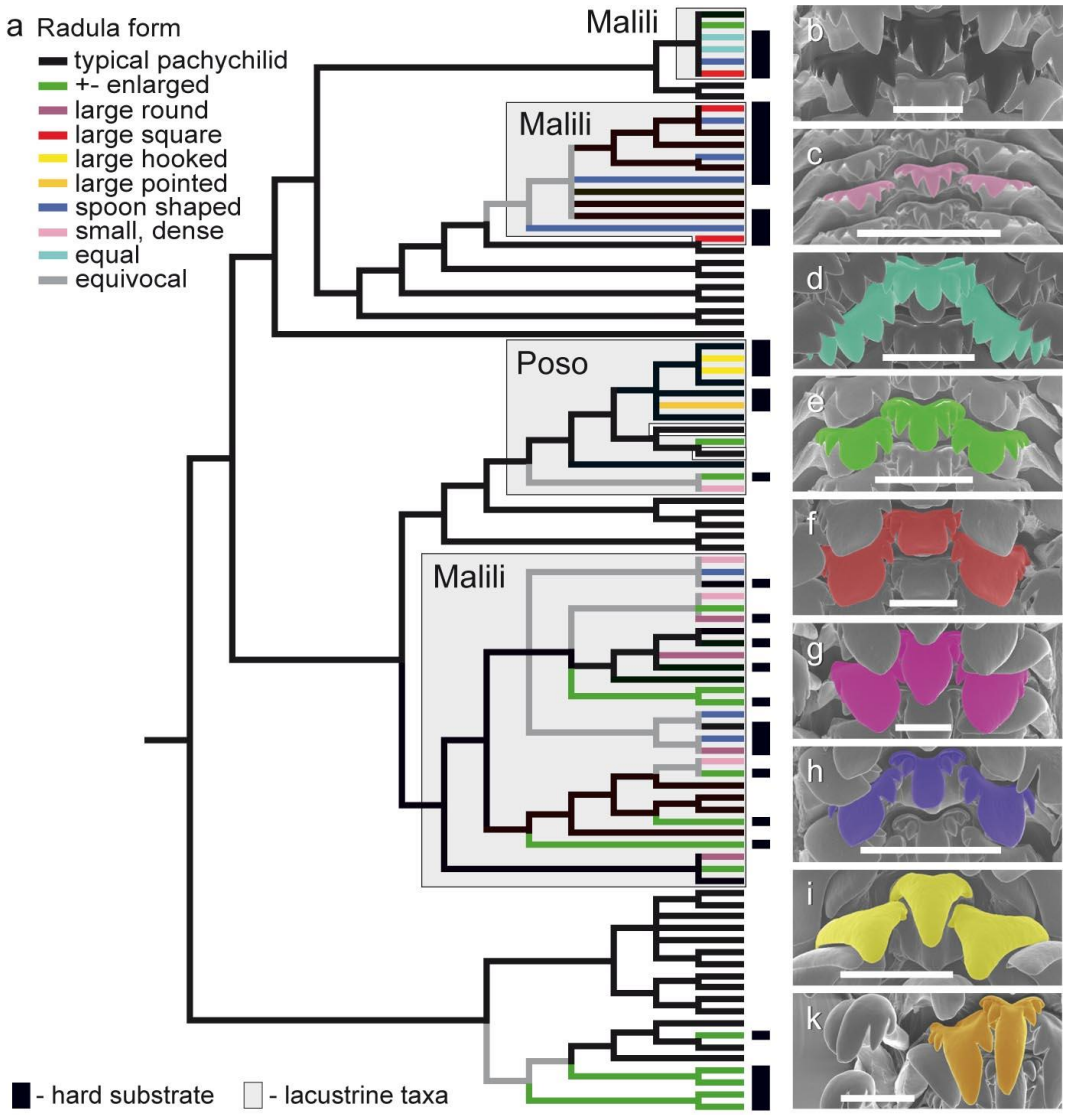




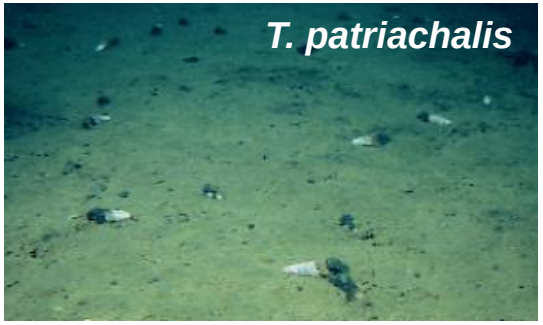
- **trophic specialisation**

  = adaptive radiation

Trophic specialisation and habitat preference



Soft substrate



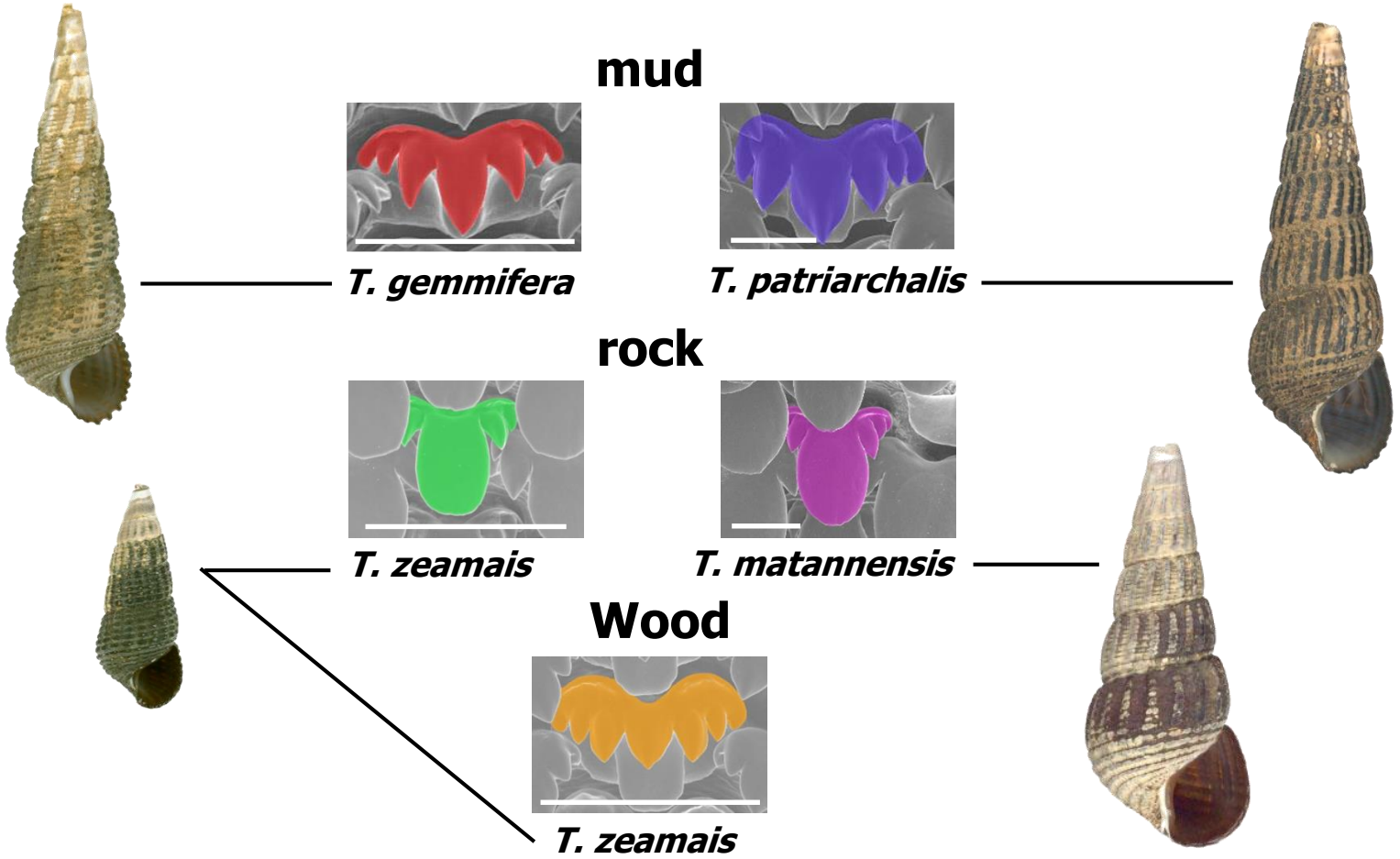
Hart substrate

Rintelen, Wilson, Meyer & Glaubrecht – *Proc. Roy. Soc* (2004)

Trophic specialisation – case study from lakes in Sulawesi

- **radula – species specific ...**

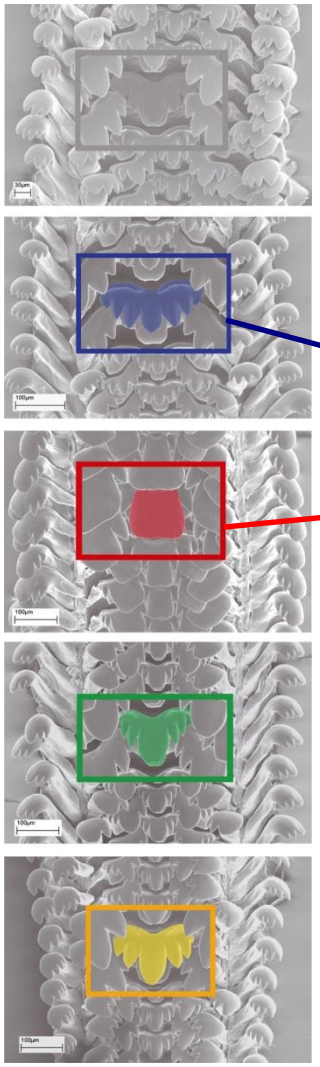
... and substrate specific

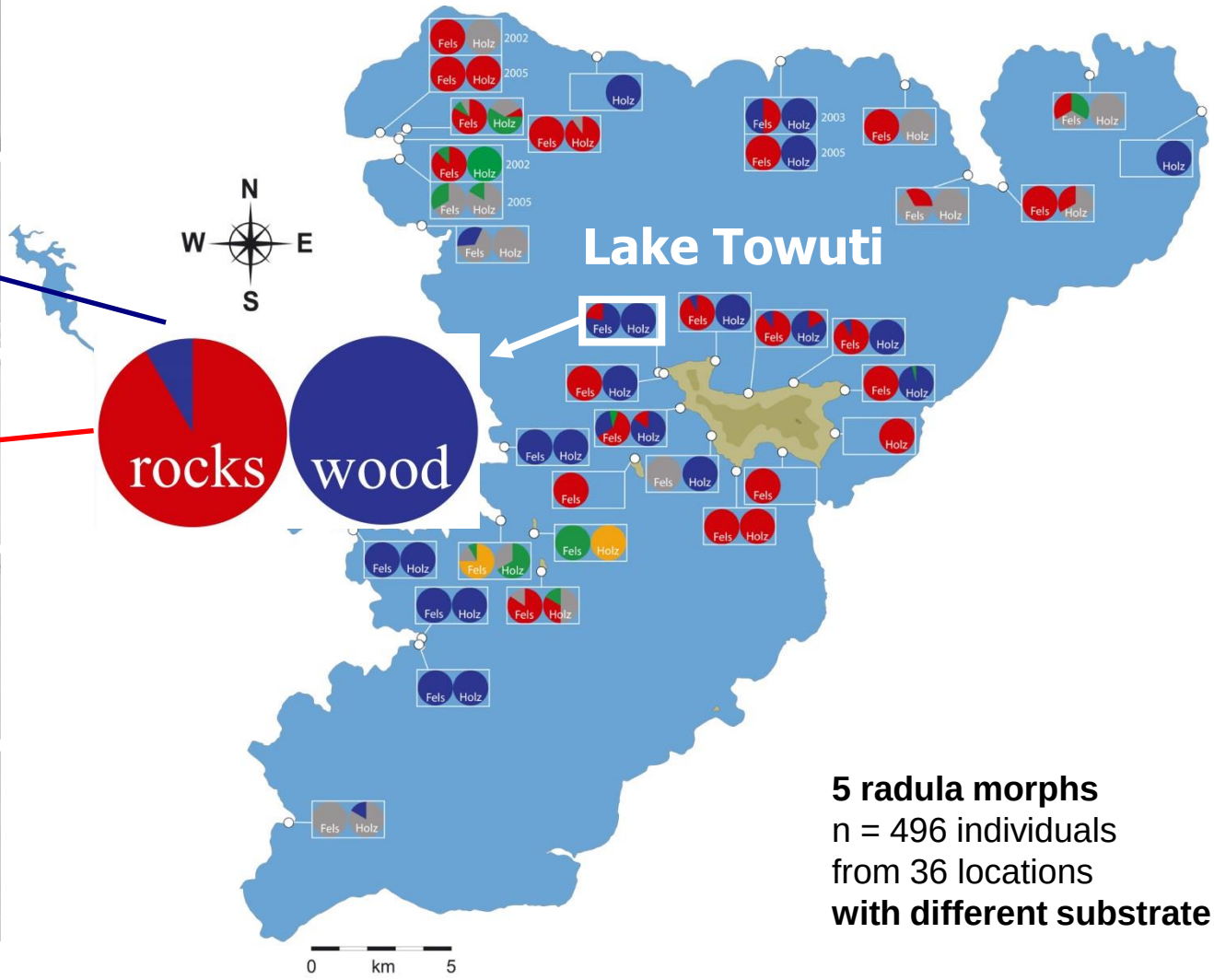


phenotype – environment correlation

Trophic specialisation – case study from Lake Matano

- **correlation or adaptation (?) in *T. sarasinorum***





5 radula morphs
n = 496 individuals
from 36 locations
with different substrate

Zur Phylogenie der Mollusca

LETTER

Resolving the evolut with phylogenomic

Stephen A. Smith[1,2], Nerida G. Wilson[3,4], Freya E. Gonzalo Giribet[5] & Casey W. Dunn[1]

Molluscs (snails, octopuses, clams and their relatives disparity of body plans and, among the animals, onl surpass them in species number. This diversity has m one of the best-studied groups of animals, yet their relationships remain poorly resolved[1]. Open qu important implications for the origin of Mollusca and logical evolution within the group. These quest whether the shell-less, vermiform aplacophoran moll before the origin of the shelled molluscs (Conchife their shells secondarily. Monoplacophorans were no molecular studies until recently[5,6], when it was propo constitute a clade named Serialia together with Po (chitons), reflecting the serial repetition of body or groups[5]. Attempts to understand the early evolutio become even more complex when considering the larg Cambrian fossils. These can have multiple dorsal sh sclerites[7–10] or can be shell-less but with a typical mol and serially repeated gills[11]. To better resolve the among molluscs, we generated transcriptome data f that, in combination with existing data, represent for all major molluscan groups. We analysed multiple c taining up to 216,402 sites and 1,185 gene regions u models and methods. Our results support the clade A taining the three molluscan groups with spicules but shells, and they support the monophyly of Conch placophora is not the sister group to other Conc Cephalopoda. Strong support is found for a clade th Scaphopoda (tusk shells), Gastropoda and Bivalvia, w lyses placing Scaphopoda and Gastropoda as sister well-resolved tree will constitute a framework for furt mollusc evolution, development and anatomy.

Since the first animal phylogenies based on molecul researchers have struggled to resolve mollusc phylog taxon sampling improved[5,6,12] (see Fig. 1 for some hypoth been proposed). Little support, if any, was found for the Mollusca or most of its larger subclades. Better results for some internal relationships of these groups, includi phora, Bivalvia, Cephalopoda, Scaphopoda and Gastrop often with difficulties recovering monophyly of the two the gastropods and bivalves[5,13,14]. Unfortunately, funda tions in mollusc evolution remain largely unanswered by and morphological data. These questions include wheth phoran molluscs are monophyletic[3] or paraphyletic[3,4]. been conflicting evidence for the placement of Polypla has been placed with the aplacophorans (forming the cl as the sister group to the shelled molluscs (forming the or as the sister group to Monoplacophora (forming the In addition, many hypotheses have been proposed for tionships of the conchiferan groups. The extensive fo

[1]Department of Ecology and Evolutionary Biology, Brown University, Providen Museum, Sydney, New South Wales 2010, Australia. [4]Scripps Institution of Ocea of Organismic and Evolutionary Biology, Harvard University, Cambridge, Mass

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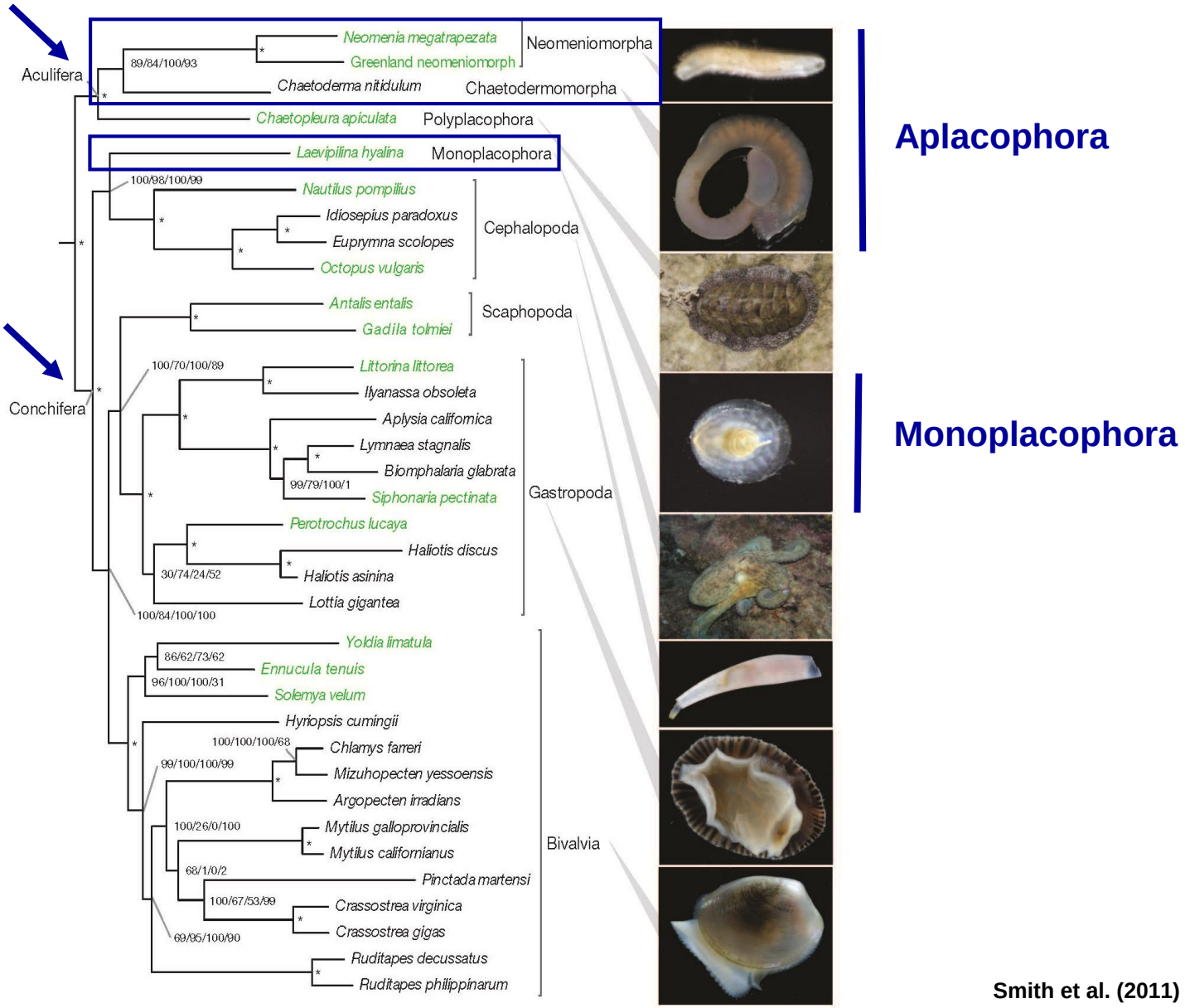
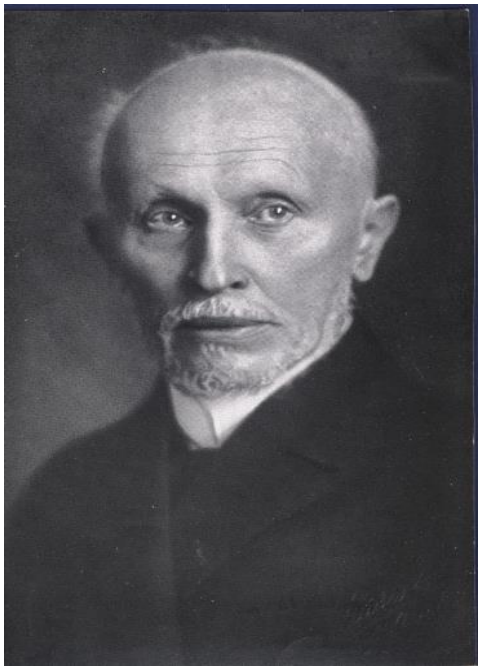


Smith et al. (2011)

Mollusca ohne Aplacophora ?

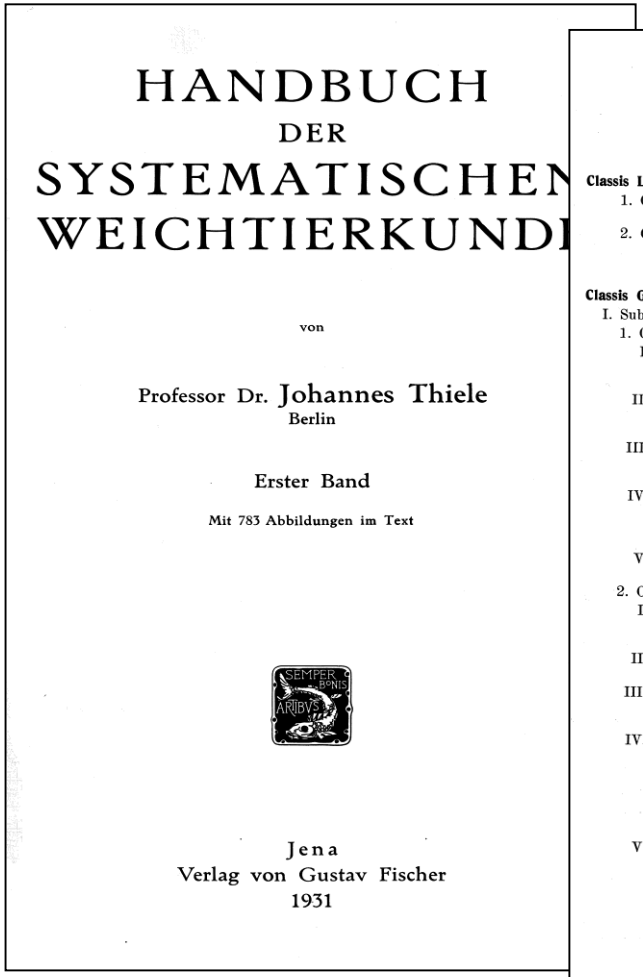
- **Thieles Irrtum – er „verbannt“ die Wurmmollusken ***



Johannes Thiele (1860 - 1935)

“Thiele has probably contributed more to malacology … than any man of his century.”

(Winckworth, 1938)



HANDBUCH
DER
SYSTEMATISCHEN
WEICHTIERKUNDE

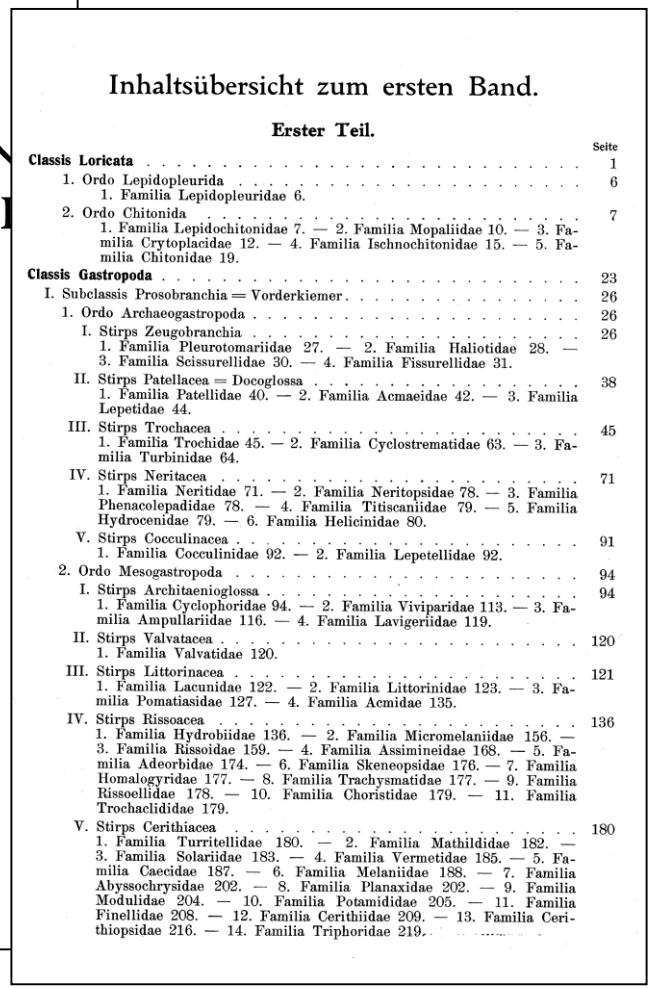
von

Professor Dr. Johannes Thiele
Berlin

Erster Band

Mit 783 Abbildungen im Text

Jena
Verlag von Gustav Fischer
1931



Inhaltsübersicht zum ersten Band.

Erster Teil.

Seite

Classis Loricata . . . 1
1. Ordo Lepidopleurida . . . 6
1. Familia Lepidopleuridae 6.
2. Ordo Chitonida . . . 7
1. Familia Lepidochitonidae 7. — 2. Familia Mopaliidae 10. — 3. Familia Crytoplacidae 12. — 4. Familia Ischnochitonidae 15. — 5. Familia Chitonidae 19.

Classis Gastropoda . . . 23
I. Subclassis Prosobranchia = Vorderkiemer . . . 26
1. Ordo Archaeogastropoda . . . 26
I. Stirps Zeugobranchia . . . 26
1. Familia Pleurotomariidae 27. — 2. Familia Haliotidae 28. — 3. Familia Scissurellidae 30. — 4. Familia Fissurellidae 31.
II. Stirps Patellacea = Docoglossa . . . 38
1. Familia Patellidae 40. — 2. Familia Acmaeidae 42. — 3. Familia Lepetidae 44.
III. Stirps Trochacea . . . 45
1. Familia Trochidae 45. — 2. Familia Cyclostrematidae 63. — 3. Familia Turbinidae 64.
IV. Stirps Neritacea . . . 71
1. Familia Neritidae 71. — 2. Familia Neritopsidae 78. — 3. Familia Phenacolepadidae 78. — 4. Familia Titiscaniidae 79. — 5. Familia Hydrocenidae 79. — 6. Familia Helicinidae 80.
V. Stirps Cocculinacea . . . 91
1. Familia Cocculinidae 92. — 2. Familia Lepetellidae 92.
2. Ordo Mesogastropoda . . . 94
I. Stirps Architaenioglossa . . . 94
1. Familia Cyclophoridae 94. — 2. Familia Viviparidae 113. — 3. Familia Ampullariidae 116. — 4. Familia Lavigeriidae 119.
II. Stirps Valvatacea . . . 120
1. Familia Valvatidae 120.
III. Stirps Littorinacea . . . 121
1. Familia Lacunidae 122. — 2. Familia Littorinidae 123. — 3. Familia Pomatiasidae 127. — 4. Familia Acmidae 135.
IV. Stirps Rissoacea . . . 136
1. Familia Hydrobiidae 136. — 2. Familia Micromelaniidae 156. — 3. Familia Rissoidae 159. — 4. Familia Assimineidae 168. — 5. Familia Adeorbidae 174. — 6. Familia Skeneopsidae 176. — 7. Familia Homalogyridae 177. — 8. Familia Trachysmatidae 177. — 9. Familia Rissoellidae 178. — 10. Familia Choristidae 179. — 11. Familia Trochaclididae 179.
V. Stirps Cerithiacea . . . 180
1. Familia Turritellidae 180. — 2. Familia Mathildidae 182. — 3. Familia Solariidae 183. — 4. Familia Vermetidae 185. — 5. Familia Caecidae 187. — 6. Familia Melaniidae 188. — 7. Familia Abyssochrysidae 202. — 8. Familia Planaxidae 202. — 9. Familia Modulidae 204. — 10. Familia Potamididae 205. — 11. Familia Finellidae 208. — 12. Familia Cerithiidae 209. — 13. Familia Cerithiopsidae 216. — 14. Familia Triphoridae 219.

* … als *phylogenetische Ausgangs- oder Elternform*

Aculifera, Conchifera & Aplacophora

- **Aculifera – „Stachelträger“**

  ohne einheitliche Schale

- **Aplacophora**

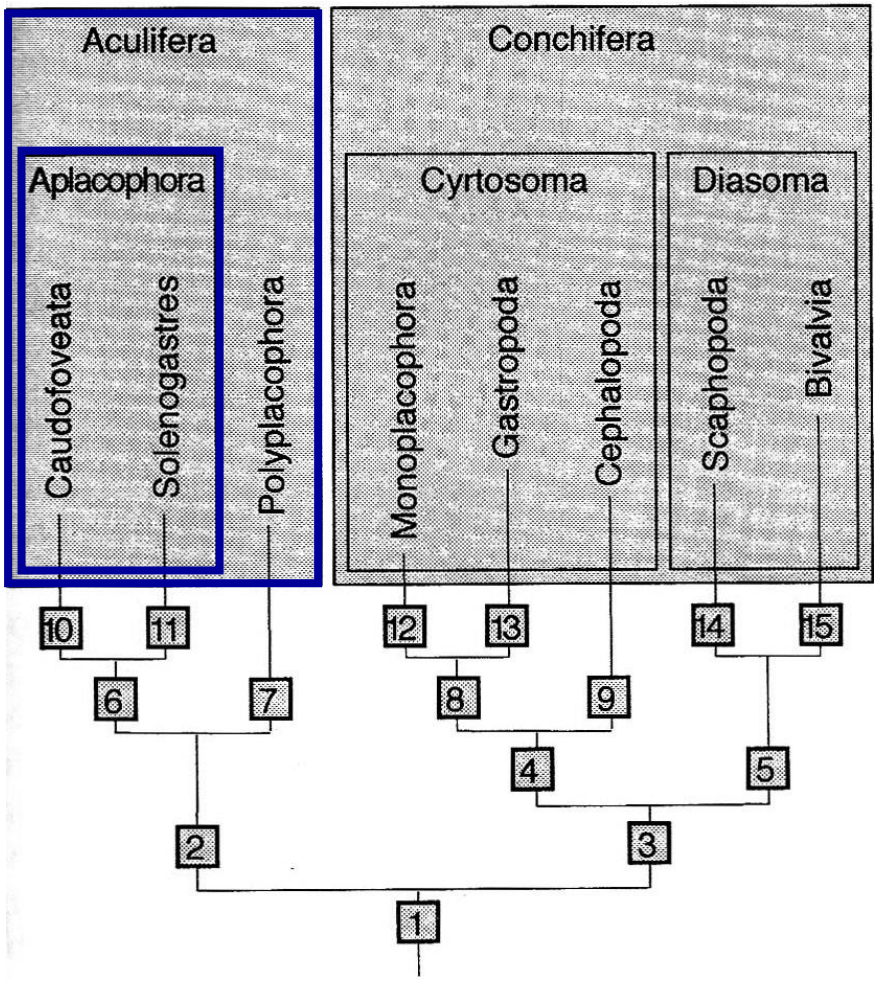
  wurmförmig, marin – ohne Schale

  - **Caudofoveata – Schildfüßer**

    - Neomeniomorpha

  - **Solenogastres – Furchenfüßer**

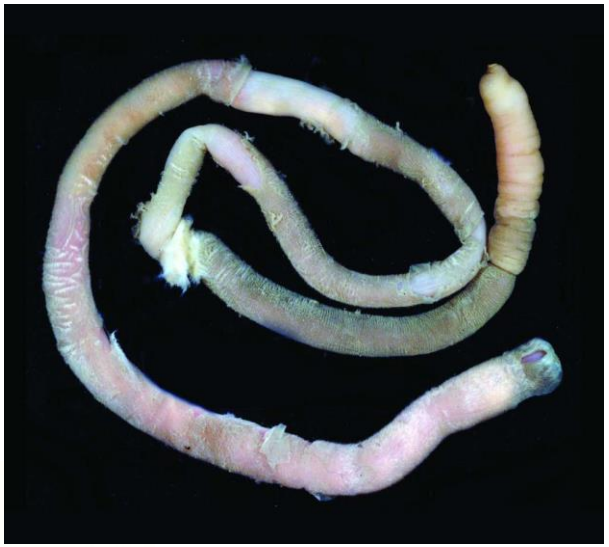
    - Chaetodermomorpha

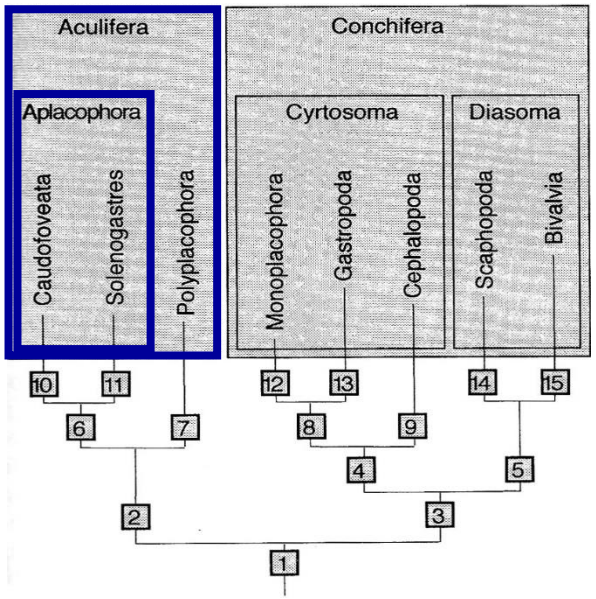


Merkmalsmosaik ! – phylogenetische Stellung ?

Caudofoveata - Schildfüßer

- **marin, wurmförmig, ohne Schale**





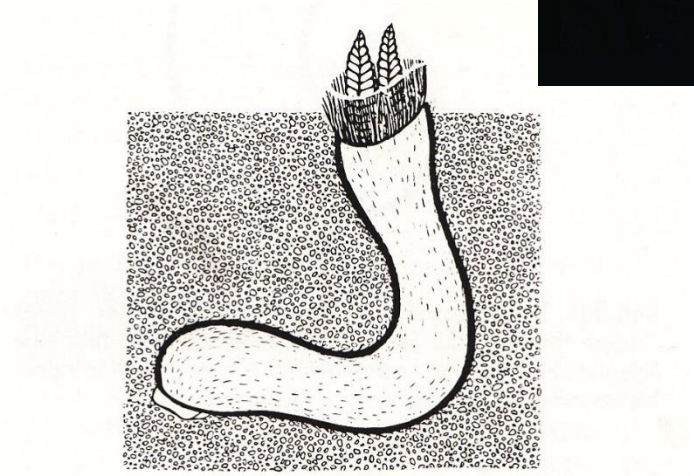


Abb. 394: Caudofoveata. Das Tier steckt kopfüber im marinen Weich-Sediment und streckt das Hinterende mit den Kiemen hervor. Aus Edlinger (1991).

- **in Gängen am Meeresboden, 20-40 m Tiefe**
- **Fußschild in Mundregion ermöglicht Eingraben**
- **meist unter 3 cm (bis selten 14 cm) lang**
- **ca. 60-120 Arten**
  z.B. *Chaetoderma nitidulum, 8 cm, W-Küste Schweden*

Caudofoveata - Schildfüßer

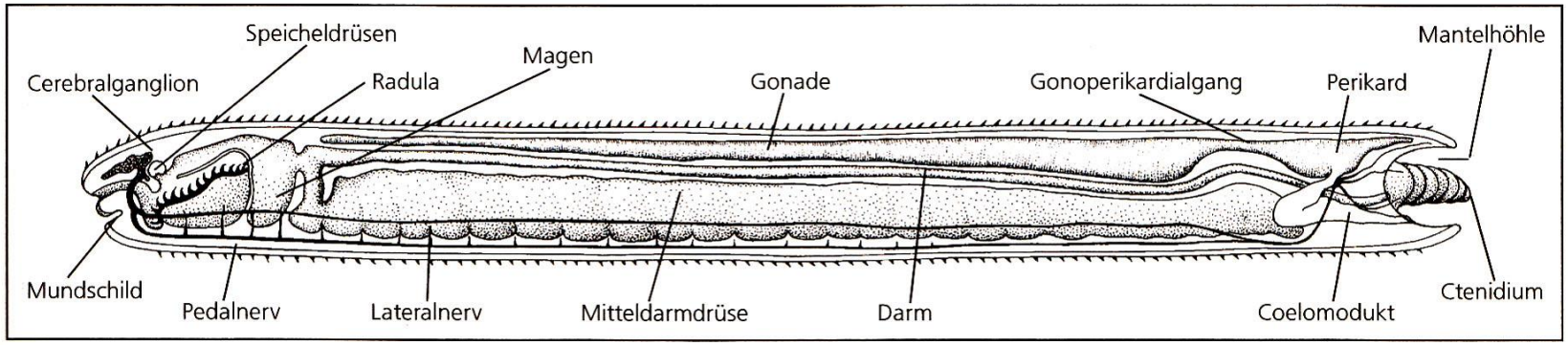


Abb. 393: Caudofoveata. Innere Organisation, Lateralansicht. Kombiniert nach Salvini-Plawen (1969) und anderen Autoren.

- **Cuticula, Spicula & Mundschild**
- **terminale Mantelhöhle mit 1 Paar Kiemen**
- **unpaare Gonade**

  getrenntgeschlechtlich, äußere Befruchtung

ohne metamere und serielle Organe !

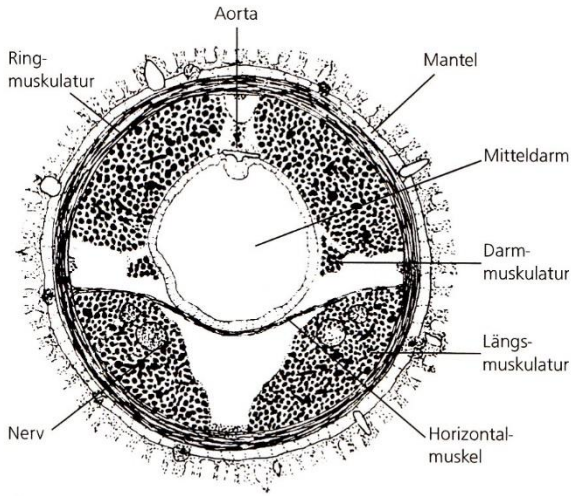


Abb. 395: Caudofoveata. Querschnitt durch die vordere Körperregion von *Chaetoderma nitidulum* (entkalkt). Aus Salvini-Plawen (1988).

Solenogastres - Furchenfüßer

- **wurmförmig, derbe Cuticula mit Kalknadeln (Spicula)**

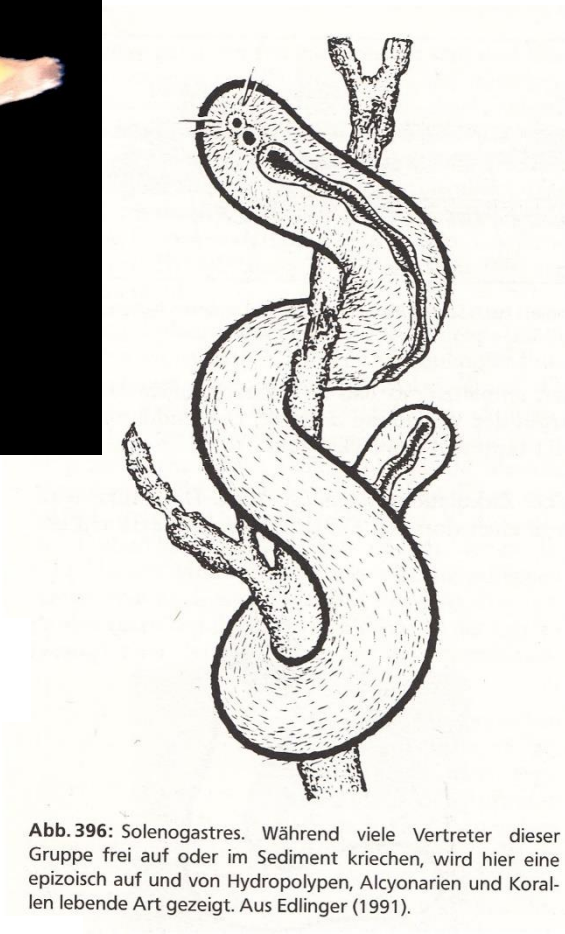


Abb. 396: Solenogastres. Während viele Vertreter dieser Gruppe frei auf oder im Sediment kriechen, wird hier eine epizoisch auf und von Hydropolypen, Alcyonarien und Korallen lebende Art gezeigt. Aus Edlinger (1991).

- **Meeresboden: epi- / benthisch – epizoisch** (gleitend-grabend)
- **ventrale Wimperfurche**
- **wenige mm (bis selten 30 cm) lang**
- **ca. 180-240 Arten, sublitoral – 4000 m Tiefe** z.B. ***Neomenia carinata***

Solenogastres - Furchenfüßer

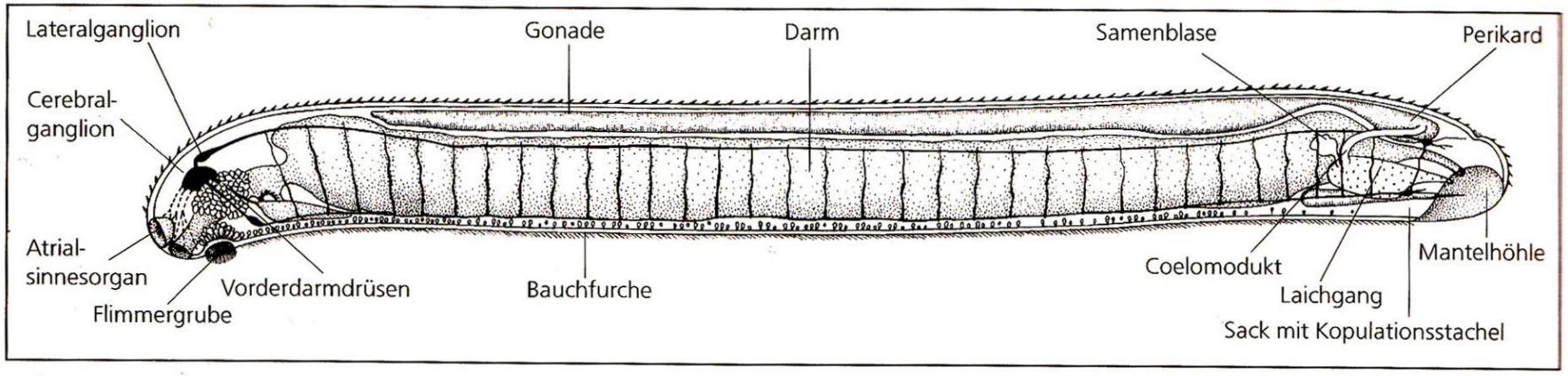
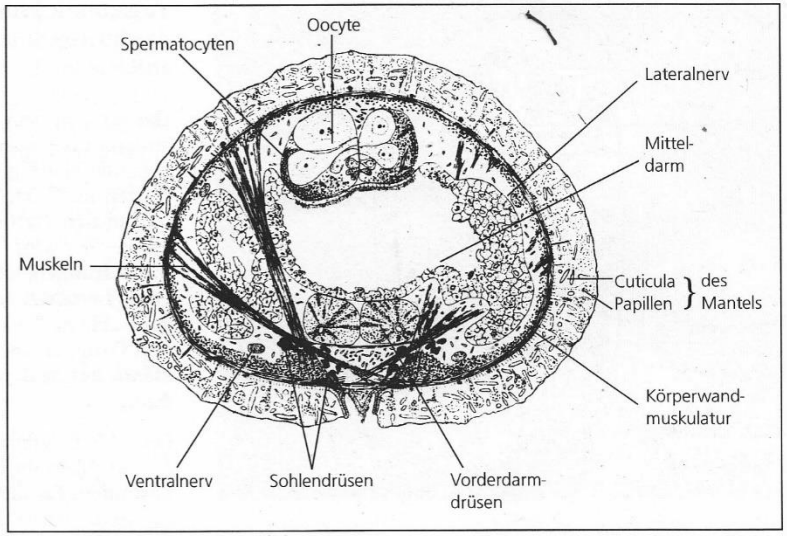


Abb. 397: Solenogastres. Innere Organisation, Lateralansicht. Kombiniert nach Salvini-Plawen (1969) und anderen Autoren.

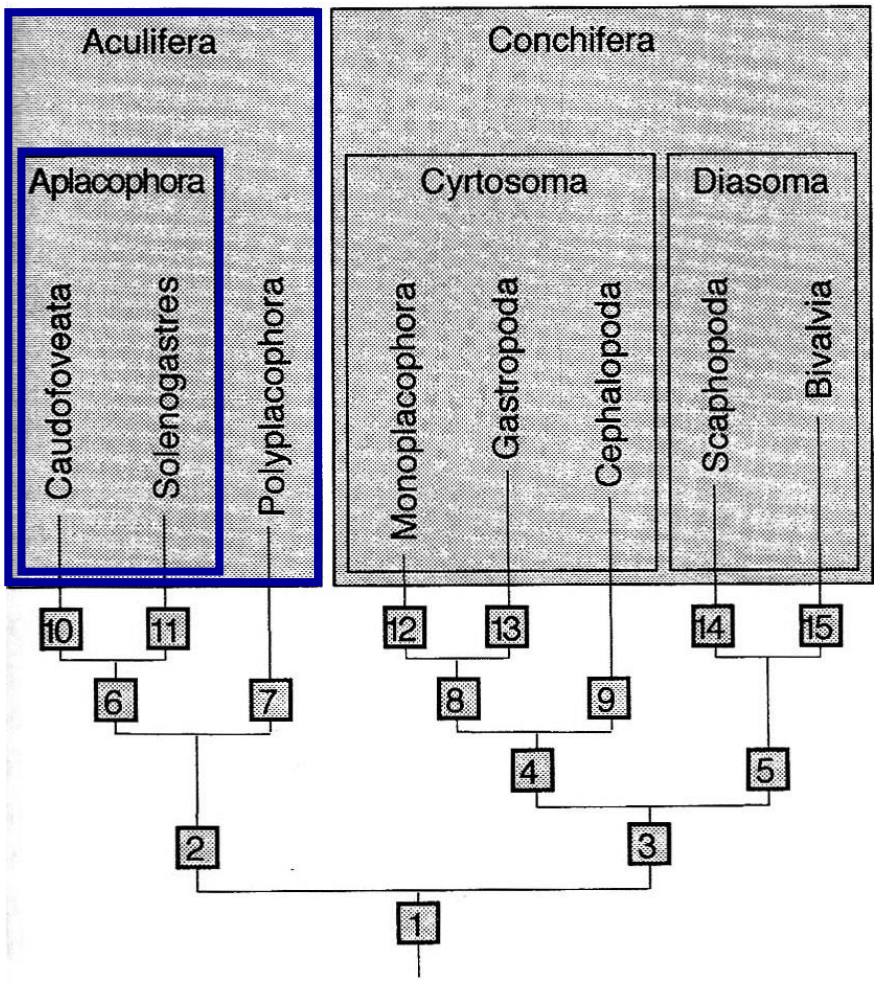
- **Ventralfurche (Fußrudiment)**
- **subterminale Mantelhöhle o. Kieme**
- **paarige Gonade**
  zwittrig, innere Befruchtung



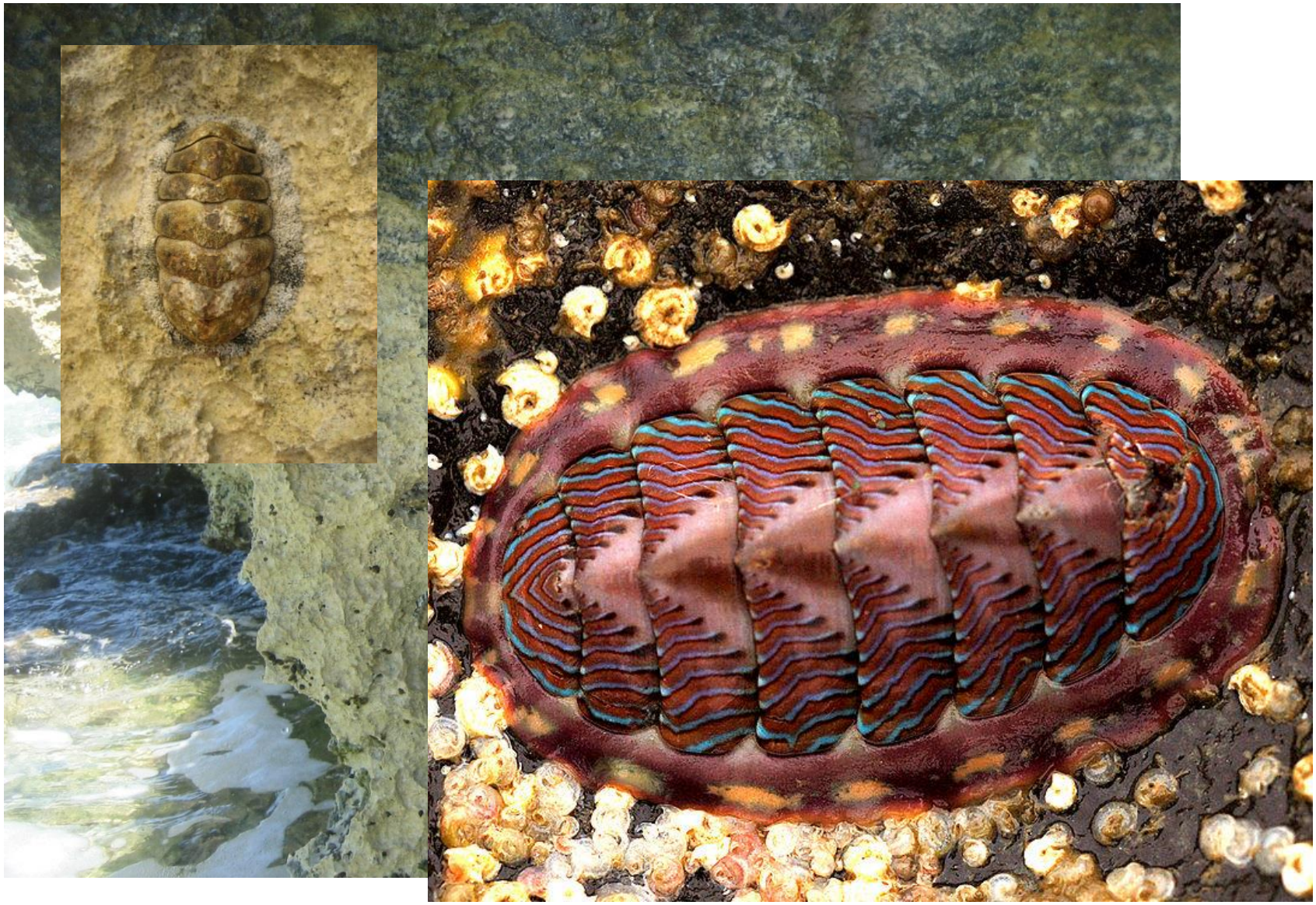
ohne metamere und serielle Organe !

Merkmalsmosaik der Wurmmollusken

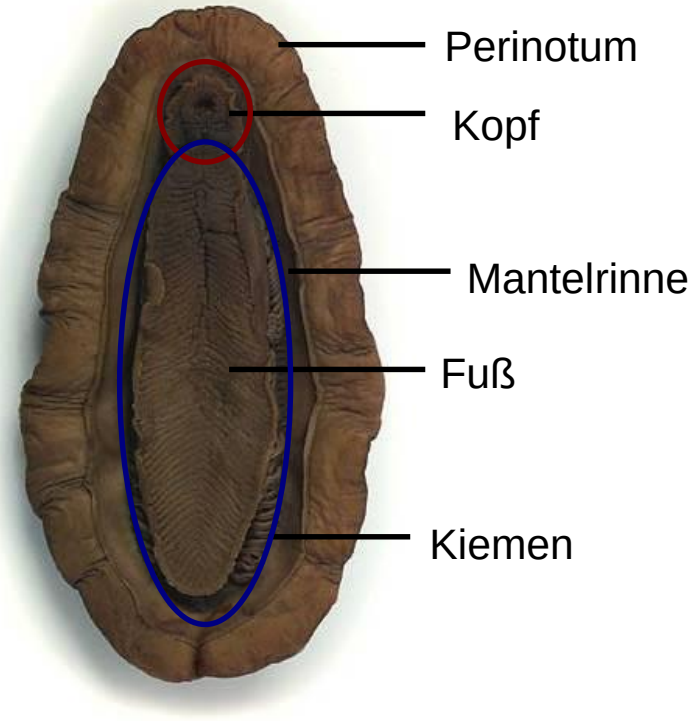
- **Genitalsystem/Pallialraum [10/11]**
  - **abgeleitet: unpaare/paarige Gonaden ohne Gänge über Pericard**
- **Körper wurmförmig [6]**
- **Cuticula [2]**
  - **Kalkstacheln bei Larven plattenartig / 7-reihig !**
- **Reduktion [1]**
  - **Fuß: nur ventrale Wimperfurche (Kriechen)**
  - **Mantelrinne: posteriore Mantelhöhle**

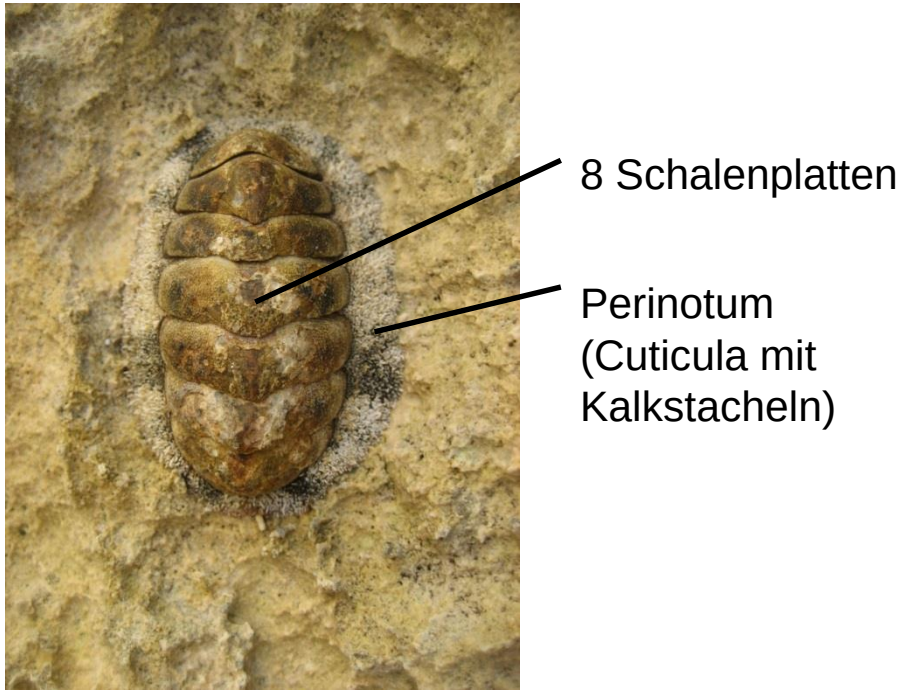


Polyplacophora (Käferschnecken)



Polyplacophora



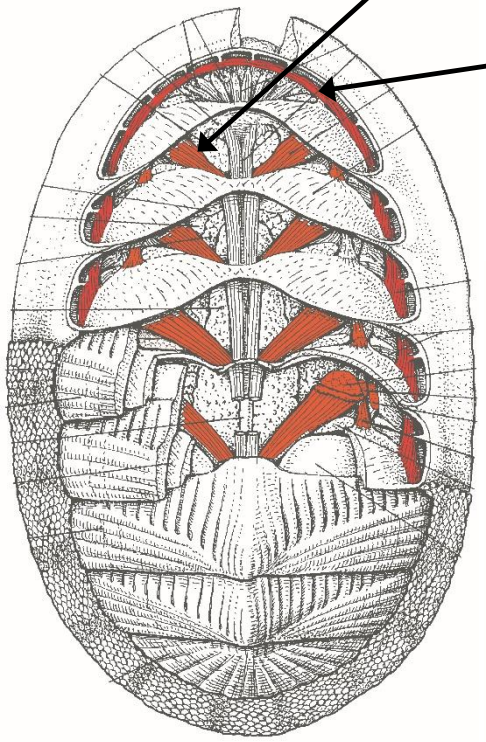


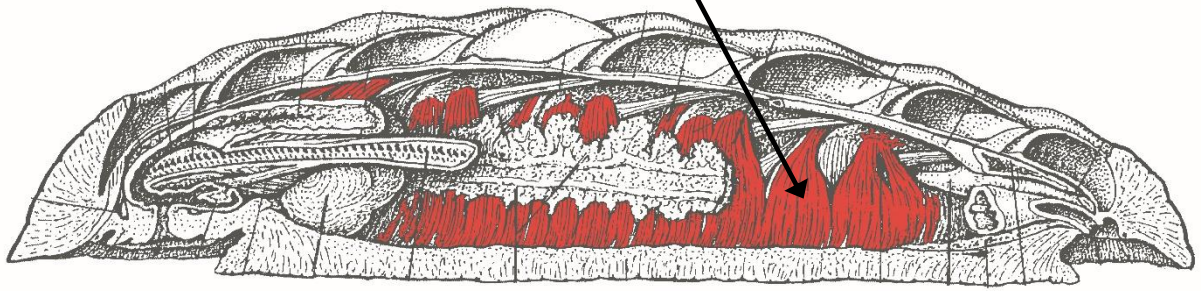
Polyplacophora

- **Muskulatur**

16 Paar Dorsoventralmuskeln
(= Fußretraktoren)

Einrollmuskel





Zur Phylogenie der Mollusca

LETTER

Resolving the evolut with phylogenomic

Stephen A. Smith[1,2], Nerida G. Wilson[3,4], Freya E. Gonzalo Giribet[5] & Casey W. Dunn[1]

Molluscs (snails, octopuses, clams and their relatives disparity of body plans and, among the animals, onl surpass them in species number. This diversity has m one of the best-studied groups of animals, yet their relationships remain poorly resolved[1]. Open qu important implications for the origin of Mollusca and logical evolution within the group. These quest whether the shell-less, vermiform aplacophoran moll before the origin of the shelled molluscs (Conchife their shells secondarily. Monoplacophorans were no molecular studies until recently[5,6], when it was propo constitute a clade named Serialia together with Po (chitons), reflecting the serial repetition of body o groups[5]. Attempts to understand the early evolutio become even more complex when considering the larg Cambrian fossils. These can have multiple dorsal sh sclerites[7–10] or can be shell-less but with a typical mol and serially repeated gills[11]. To better resolve the among molluscs, we generated transcriptome data f that, in combination with existing data, represent for all major molluscan groups. We analysed multiple d taining up to 216,402 sites and 1,185 gene regions u models and methods. Our results support the clade A taining the three molluscan groups with spicules but shells, and they support the monophyly of Conch placophora is not the sister group to other Conc Cephalopoda. Strong support is found for a clade th Scaphopoda (tusk shells), Gastropoda and Bivalvia, w lyses placing Scaphopoda and Gastropoda as sister well-resolved tree will constitute a framework for furt mollusc evolution, development and anatomy.

Since the first animal phylogenies based on molecul researchers have struggled to resolve mollusc phylog taxon sampling improved[5,6,12] (see Fig. 1 for some hypoth been proposed). Little support, if any, was found for the Mollusca or most of its larger subclades. Better results for some internal relationships of these groups, includi phora, Bivalvia, Cephalopoda, Scaphopoda and Gastrop often with difficulties recovering monophyly of the two the gastropods and bivalves[5,13,14]. Unfortunately, funda tions in mollusc evolution remain largely unanswered by and morphological data. These questions include wheth phoran molluscs are monophyletic[3] or paraphyletic[3,4]. been conflicting evidence for the placement of Polypla has been placed with the aplacophorans (forming the cl as the sister group to the shelled molluscs (forming the or as the sister group to Monoplacophora (forming the In addition, many hypotheses have been proposed for tionships of the conchiferan groups. The extensive fo

[1]Department of Ecology and Evolutionary Biology, Brown University, Providen Museum, Sydney, New South Wales 2010, Australia. [4]Scripps Institution of Ocea of Organismic and Evolutionary Biology, Harvard University, Cambridge, Mass

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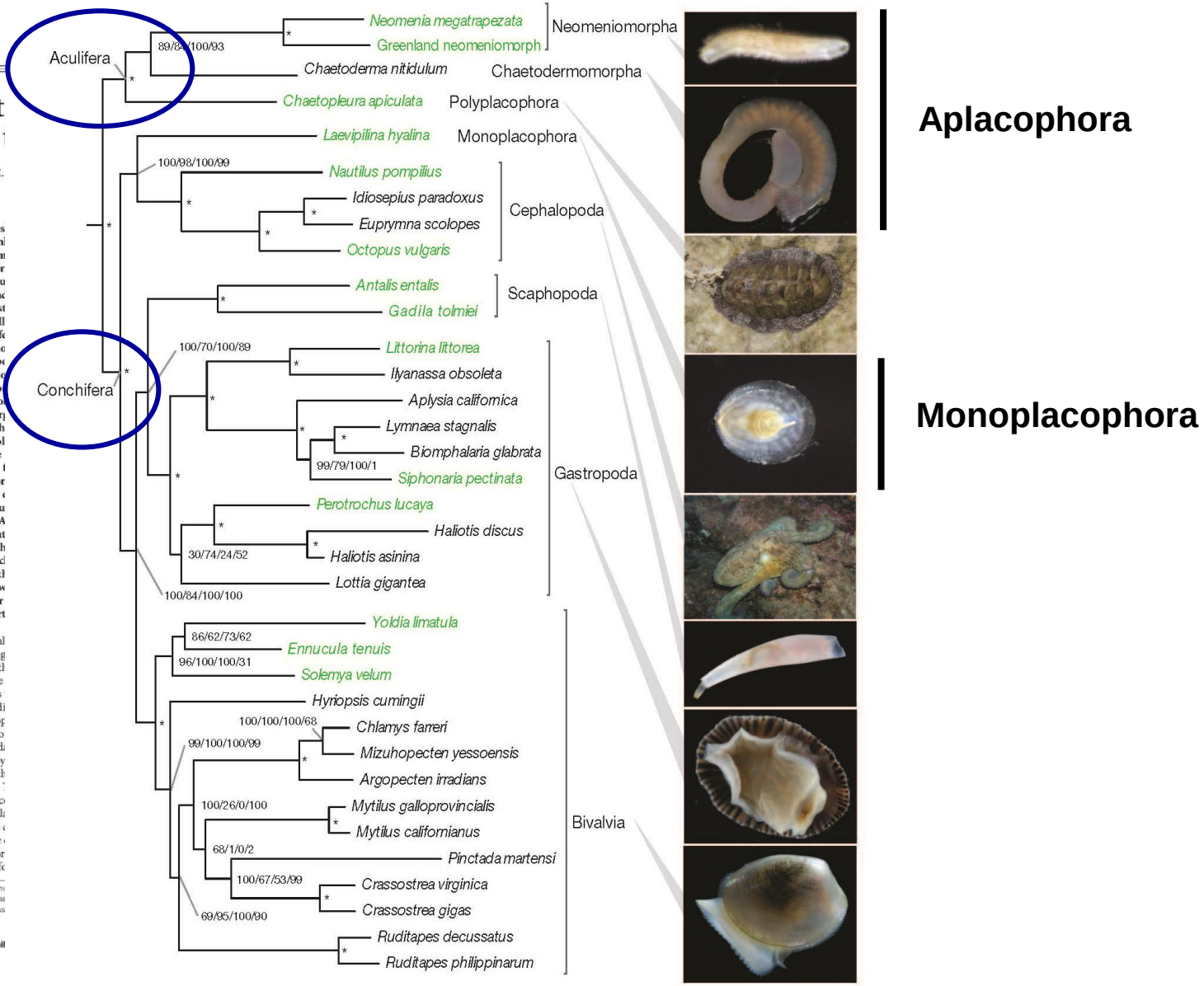
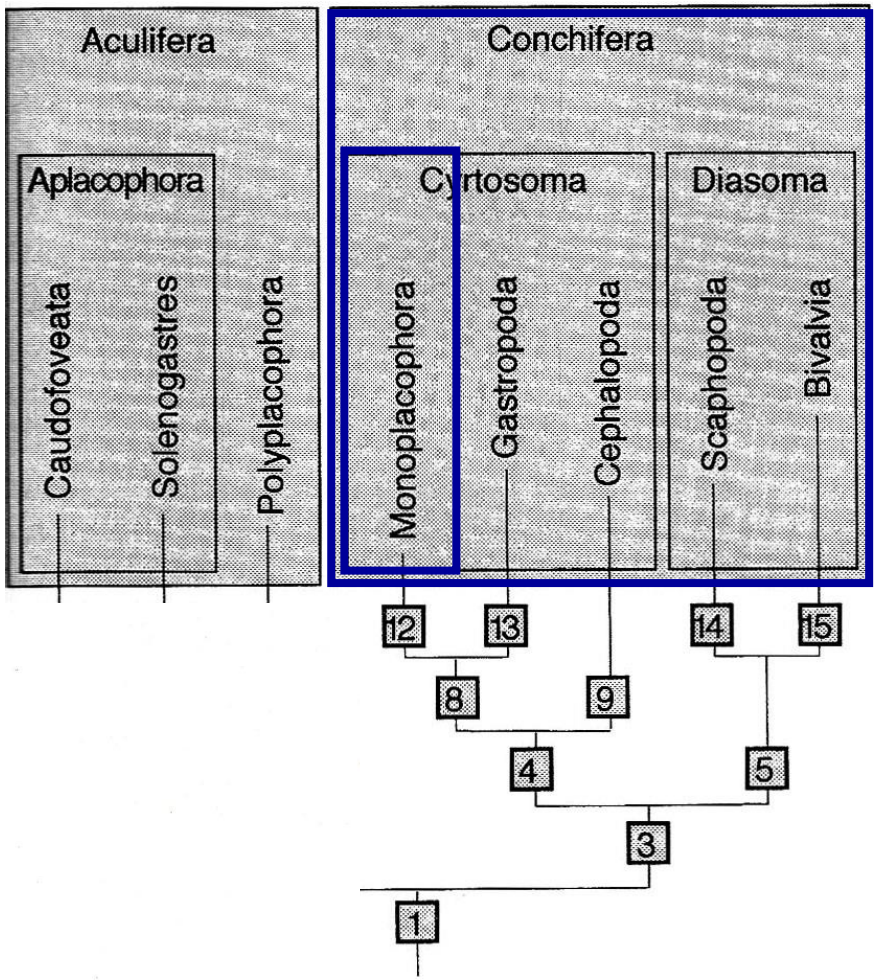


Conchifera - Schalenträger

Monoplacophora

- Urmützenschnecken, Napfschaler

- **einteilige Schale [3]** **statt Cuticula & Spicula**
  einheitlich, bisweilen zweiklappig
  von Rinne am Mantelrand abgeschieden [8]



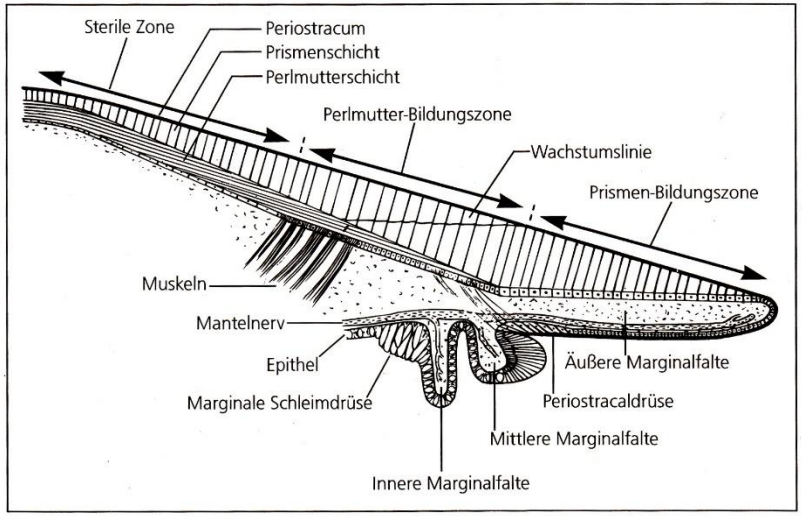


Abb. 403: Conchifera. Mantelrand und Schalenschichten in typischer Anordnung (*Neopilina galatheae*). Nach Lemche und Wingstrand (1959) aus Götting (1974).

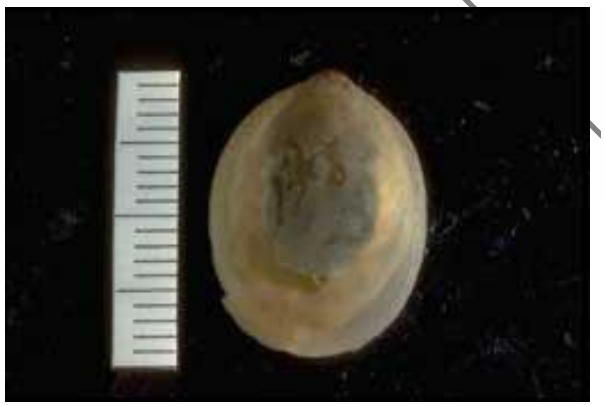
Mollusca

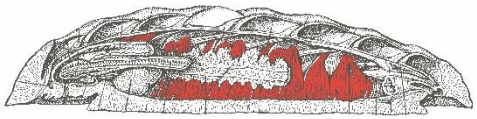
Caudofoveata
Solenogastres
Polyplacophora
Monoplacophora
Ganglioneura

1 Paar

8 Paar

16 Paar Fußretraktoren





Monoplacophora
(Urmützenschnecken)
haben 8 Paar Fußretraktoren, aber nur 1 Schale

Monoplacophora – „Urmollusk / Urconchifer“

- **im Paläozoikum weit verbreitet**

- **rezent seit 1952 - *Neopilina***

  - **Napfschale (dreischichtig)**

  - **metamere Organe**

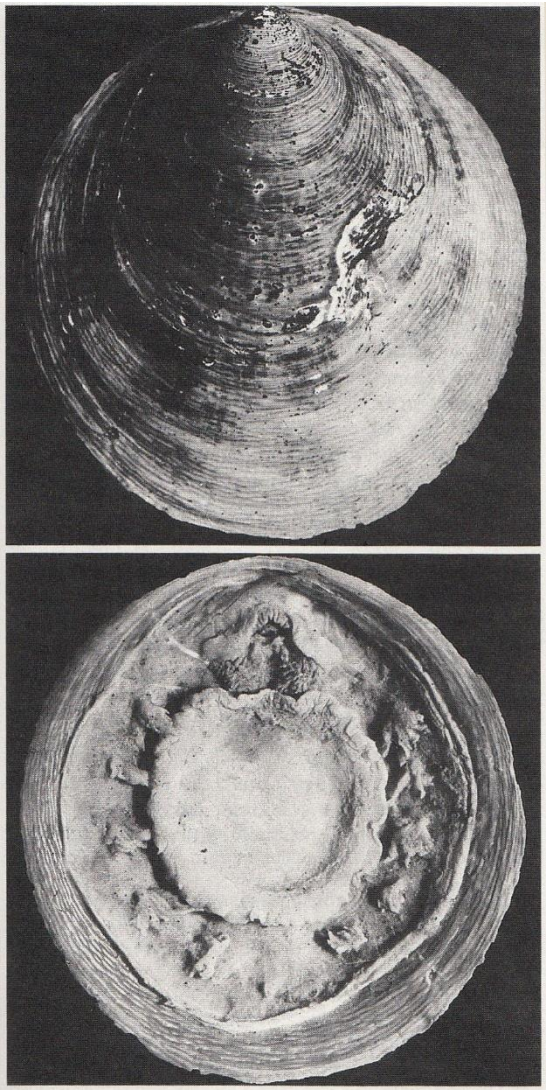
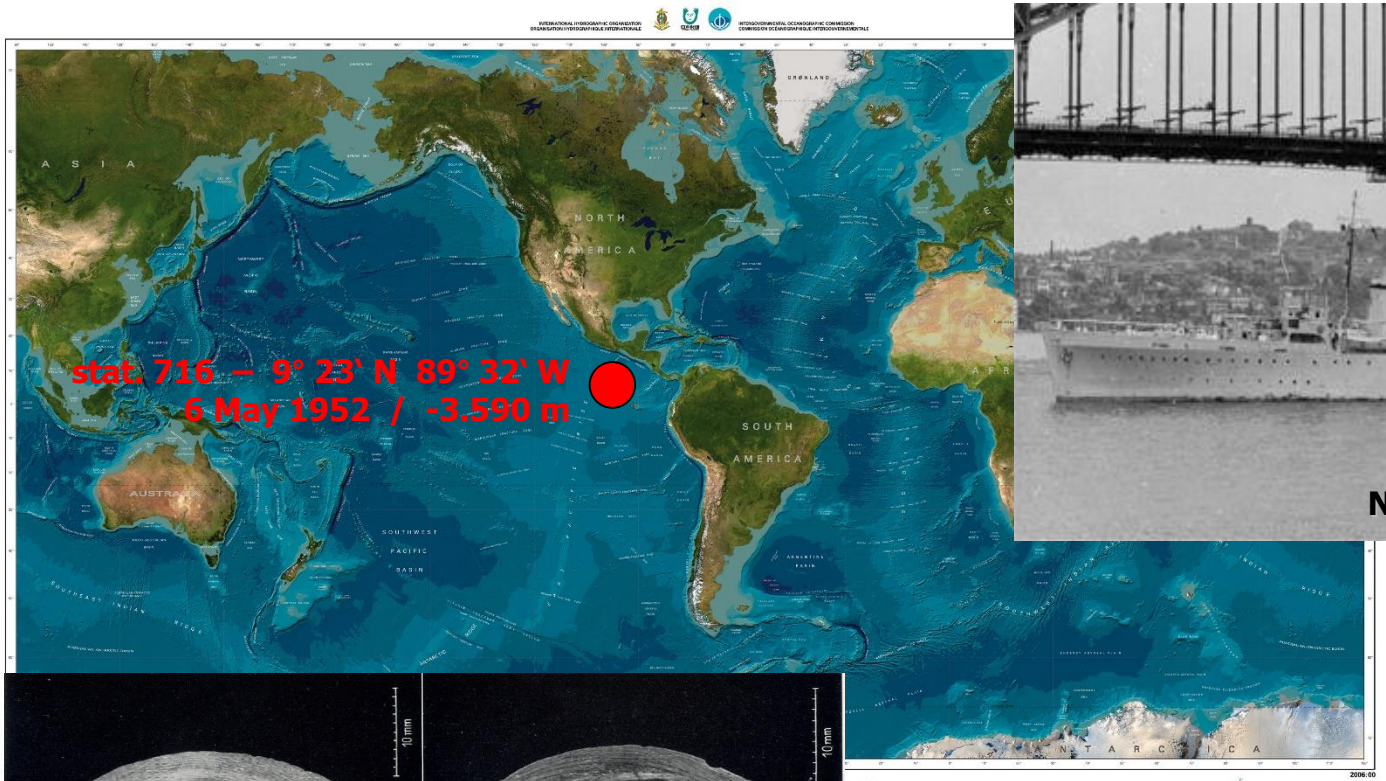


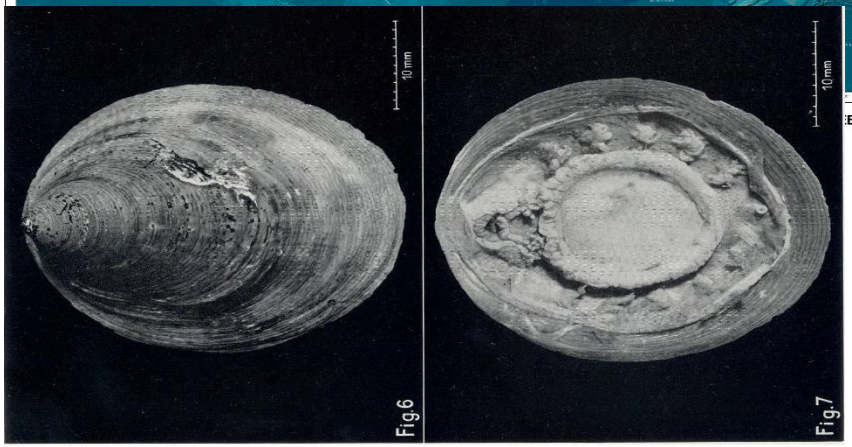
Abb. 404: *Neopilina galatheae* (Monoplacophora). A Aufsicht, Vorderende oben. B Ventralansicht mit Mundfeld, Fuß und Mantelrinne mit Kiemen. Aus Lemche und Wingstrand (1959).

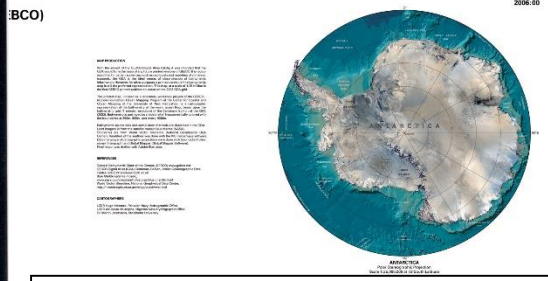
Die Entdeckung eines „lebenden Fossils“

Dänische Tiefsee - Expedition 1950-52



Navy fregate „*Galathea*"

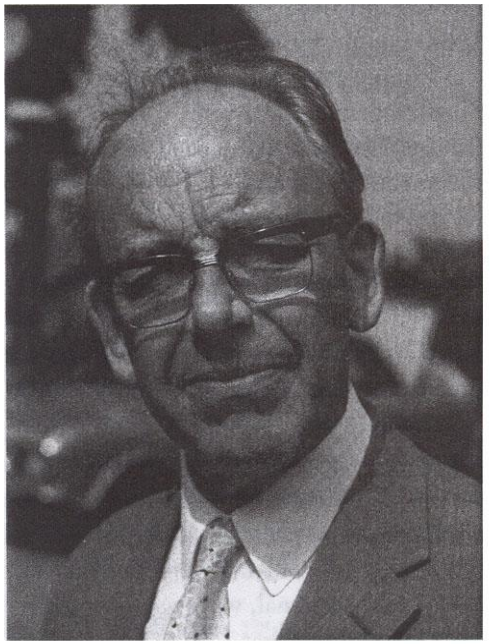




10 Napfschnecken ähnliche Weichtiere, 3 - 4 mm

Lebende Monoplacophora - Neopilina galatheae Lemche, 1957

„primitive patelliform mollusc“ - „missing link“ – „living fossil“



Henning Lemche (1904-1977)

With the compliments
of the author

(*Reprinted from Nature, Vol.* 179, *pp.* 413–416, *Feb.* 23, 1957)

A NEW LIVING DEEP-SEA MOLLUSC OF THE CAMBRO-DEVONIAN CLASS MONOPLACOPHORA

By Dr. HENNING LEMCHE
Universitetets Zoologiske Museum, Copenhagen

WHEN dredging off the Mexican west coast, the *Galathea* Expedition made a rich haul at station 716. The many interesting animals found there include some specimens of a hitherto unknown patelliform mollusc, the study of which has already revealed so many interesting new facts that a preliminary note seems justified.

Class Monoplacophora Odhner, 1940

This name was proposed originally by Odhner (in Wenz[1]) to cover a group of extinct palæozoic molluscs hitherto regarded as primitive Patellacea, but differing from these in having six pairs of muscle scars arranged symmetrically on the inside of the shell. To-day, the diagnosis may be modified as follows.

Almost bilaterally symmetrical molluscs with internal metamerism. A single piece of shell covers the pallium which extends all over the dorsum. Anus postero-median. Coelomic cavities well developed. The metamerically arranged, paired auricles deliver the blood to the two symmetrical, long ventricles, each on either side of the intestine. Metamerically arranged nephridia arise from the coelomic sacs to open on the surface in the pallial furrow. Gonads symmetrically arranged, possibly metameric, opening through the nephridia. Nervous system primitively orthoneurous.

Order Tryblidiacea Wenz, 1938

Monoplacophora with a head region and five well-developed metameres. The muscles of the head region indicate this part of the animal consists of three more metameres. The shell is spoon-shaped, cap-shaped, or conical, sometimes rather curved, with the apex more or less anterior or overhanging the anterior margin. No distinct pallial cavity, but there is a broad space or furrow all the way round between the pallium and the head and body, the pallial border thus continuing along the whole anterior side of the animal in front of the head. The mouth is placed ventrally at a little distance from

- **großartige biologische Entdeckung: *„molluscan coelacanth“***
- **verwandt mit paläozänen Tryblidia (ausgestorben seit dem Devon - 375 mya) einst nur im Flachwasser**

Nature, 1957

Morphologie eines Napfschalers

- **paarige Kiemen & Nephridien (6)**
- **paarige D/V-Muskeln (8)**
- **großes Coelom**
- **großer Fuß**
- **Radula rhipidogloss**

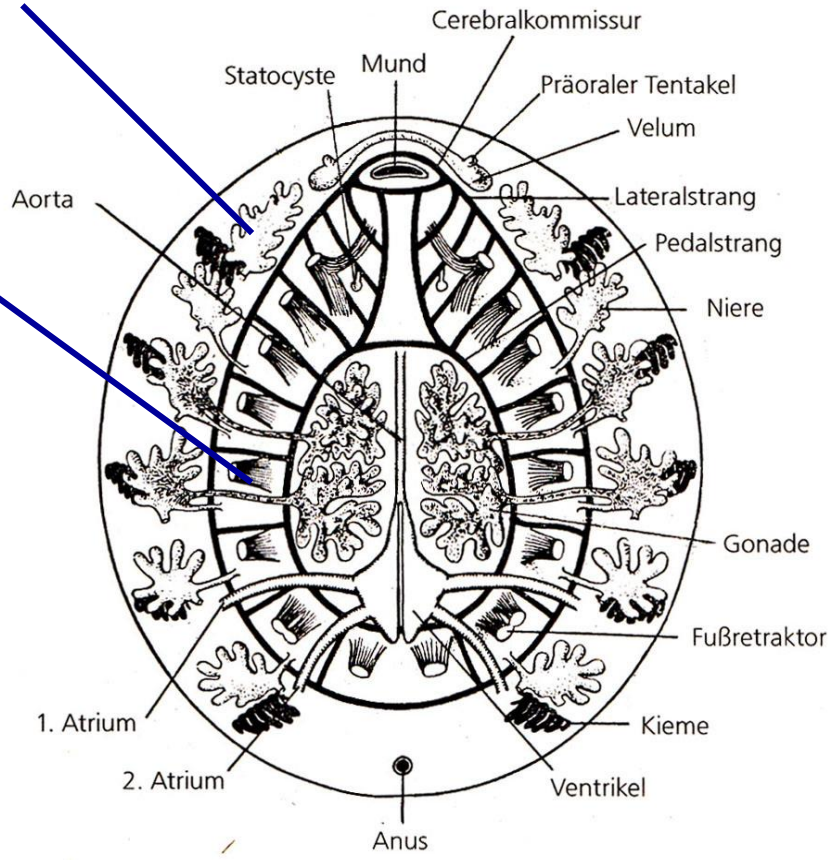


Abb. 405: Monoplacophora (*Neopilina galatheae*). Schema der inneren Organisation. Verdauungssystem weggelassen. Verändert nach Lemche und Wingstrand (1959) und Salvini-Plawen (1981).

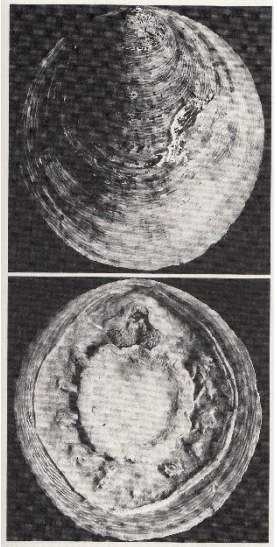
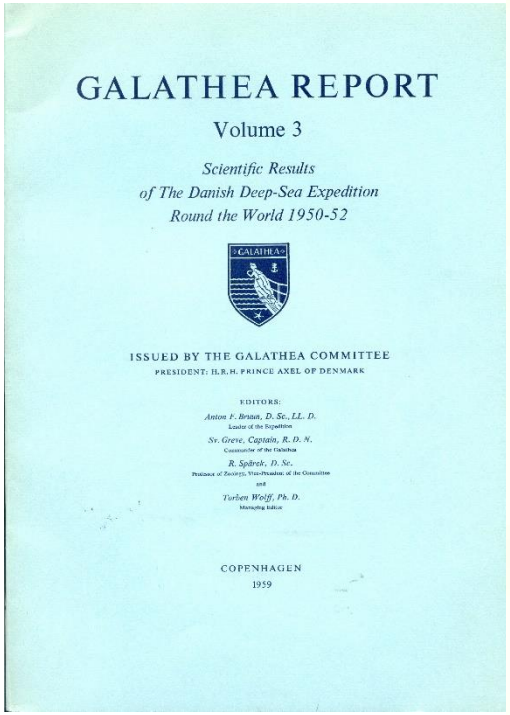


Abb. 404: *Neopilina galatheae* (Monoplacophora). A Aufsicht, Vorderende oben. B Ventralansicht mit Mundfeld, Fuß und Mantelrinne mit Kiemen. Aus Lemche und Wingstrand (1959).

Neopilina galatheae - ein „Ur-Mollusk“ - Lemche & Wingstrand, 1959

- **Serialität & Metamerie**


GALATHEA REPORT

Volume 3

Scientific Results of The Danish Deep-Sea Expedition Round the World 1950-52

ISSUED BY THE GALATHEA COMMITTEE

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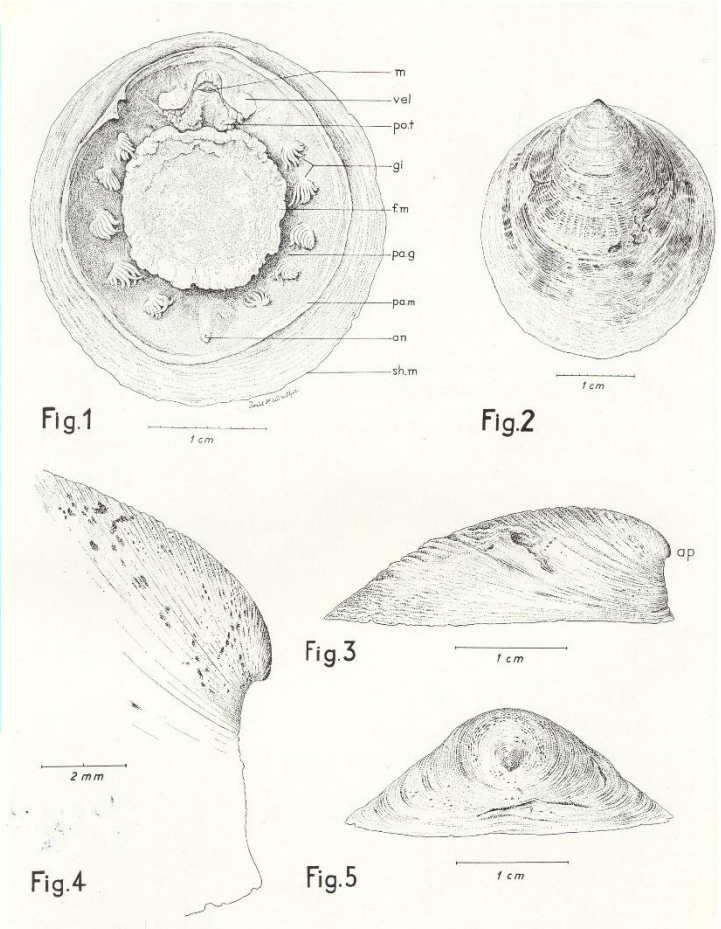
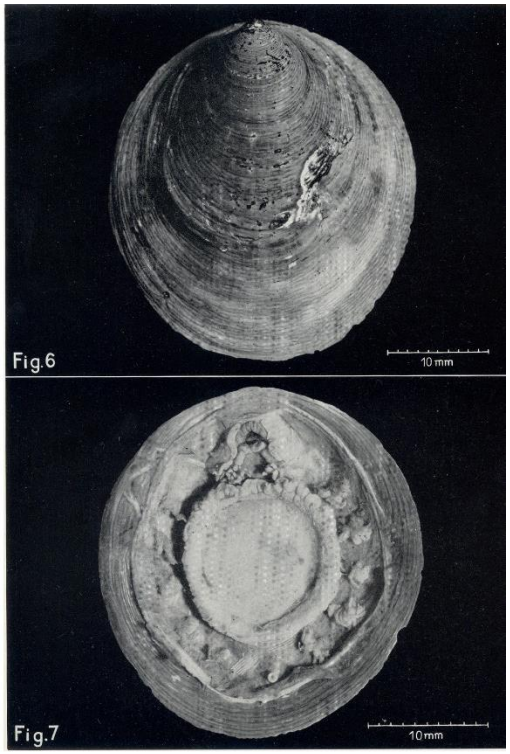
COPENHAGEN

1959





- bilateral-symmetrisch
  napfschneckenartig

- serielle Wiederholung
  metamer = segmentiert ?

- **enge Verwandtschaft: Monoplacophora + Annelida**

Revision von Neopilina - *Wingstrand, 1985*

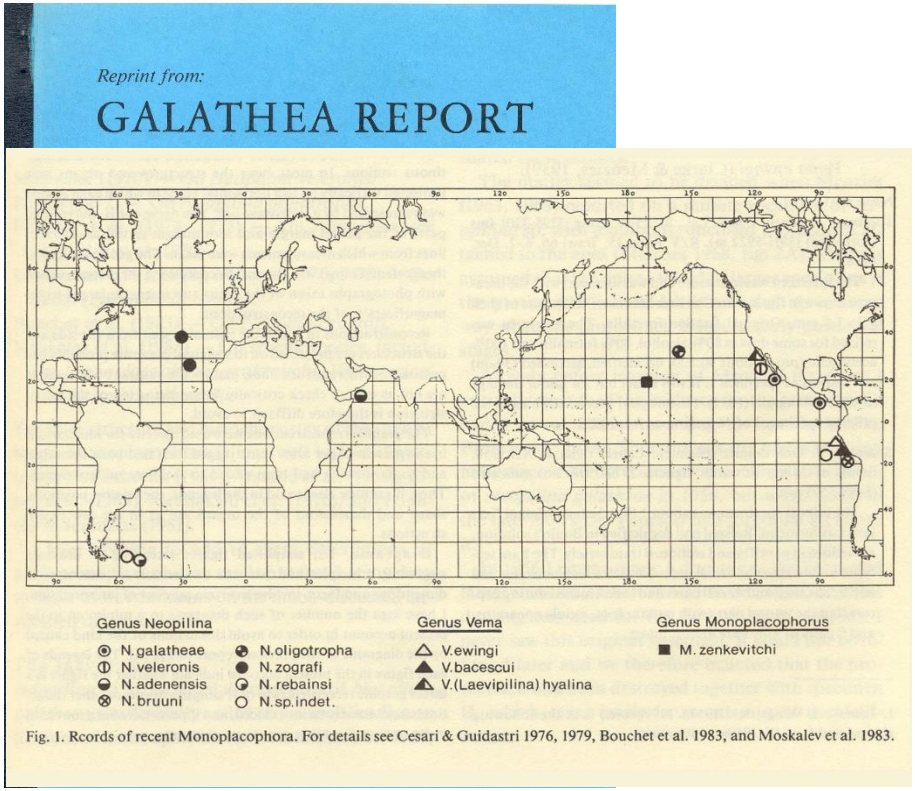


Fig. 1. Rcords of recent Monoplacophora. For details see Cesari & Guidastri 1976, 1979, Bouchet et al. 1983, and Moskalev et al. 1983.

- mehr Arten & Vorkommen

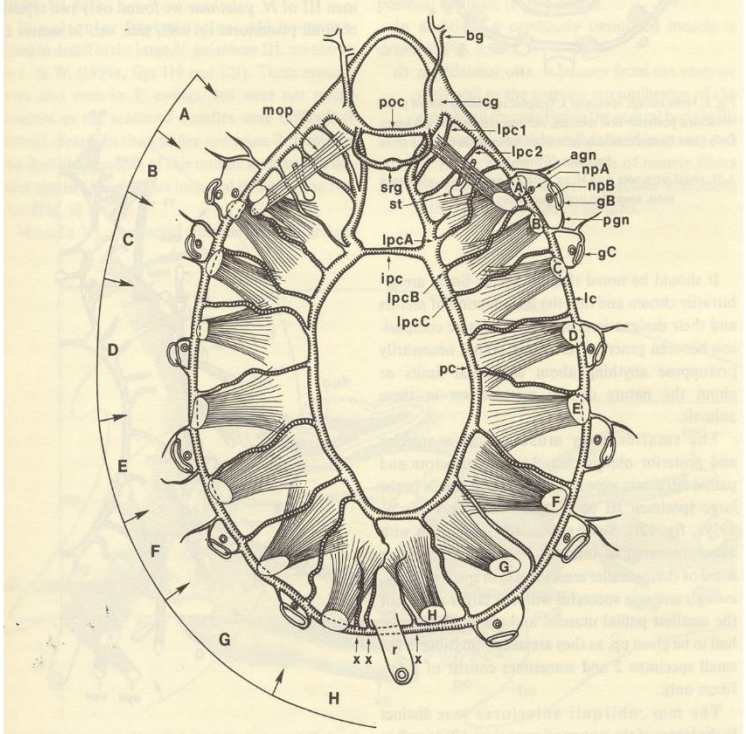


Fig. 4. *Vema ewingi*, specimen 2. Graphic reconstruction of muscles, nervous system, gill bases and nephridiopores. The sector sequence (see Chapter 4.2) is indicated to the left. Dorsal view.
A-H, pedal retractors A to H; agn, anterior gill nerve; bg, buccal ganglion; cg, cerebral ganglion; gB, gill B; gC, gill C; ipc, interpedal commissure; lc, lateral nerve cord; lpc 1, lpc 2, lateropedal connective 1 and 2; lpcA-lpcC, lateropedal connectives A to C; mop, musculus oralis posterior; pc, pedal nerve cord; pgn, posterior gill nerve; poc, postoral commissure; npA and npB, nephridiopore A and B; r, rectum; st, statocyst; srg, subradular ganglion; x, "extra" lateropedal connectives behind retractor H.

- ohne spiralige Larvalschale & Coelomsäcke

- seriell & metamer, aber nicht segmentiert

- **als Conchifera bestätigt – Schwestergruppe der Polyplacophora (Käferschnecken)**

Monoplacophora heute

- **29 beschriebene Arten in 9 Gattungen**
  2 (-7) Familien lebender Monoplacophora

Family Neopilinidae Lemche, 1957

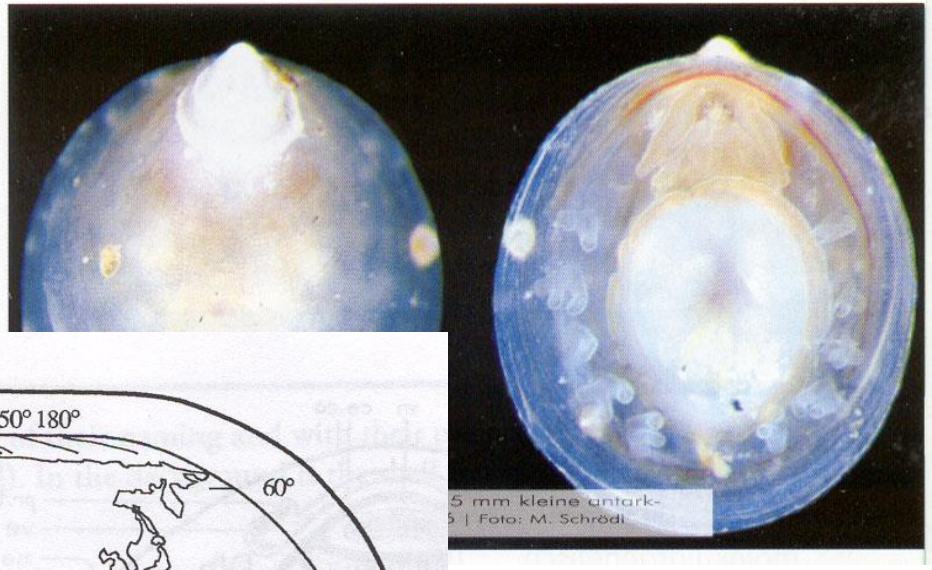
Genus *Neopilina* Lemche, 1957

[a]*Neopilina (N.) galatheae* (Lemche 1957: 414, figs. 1–4): 37 mm; off Coasta Rica, 9°23´N, 89°32´W, 3,590–3,718 m.

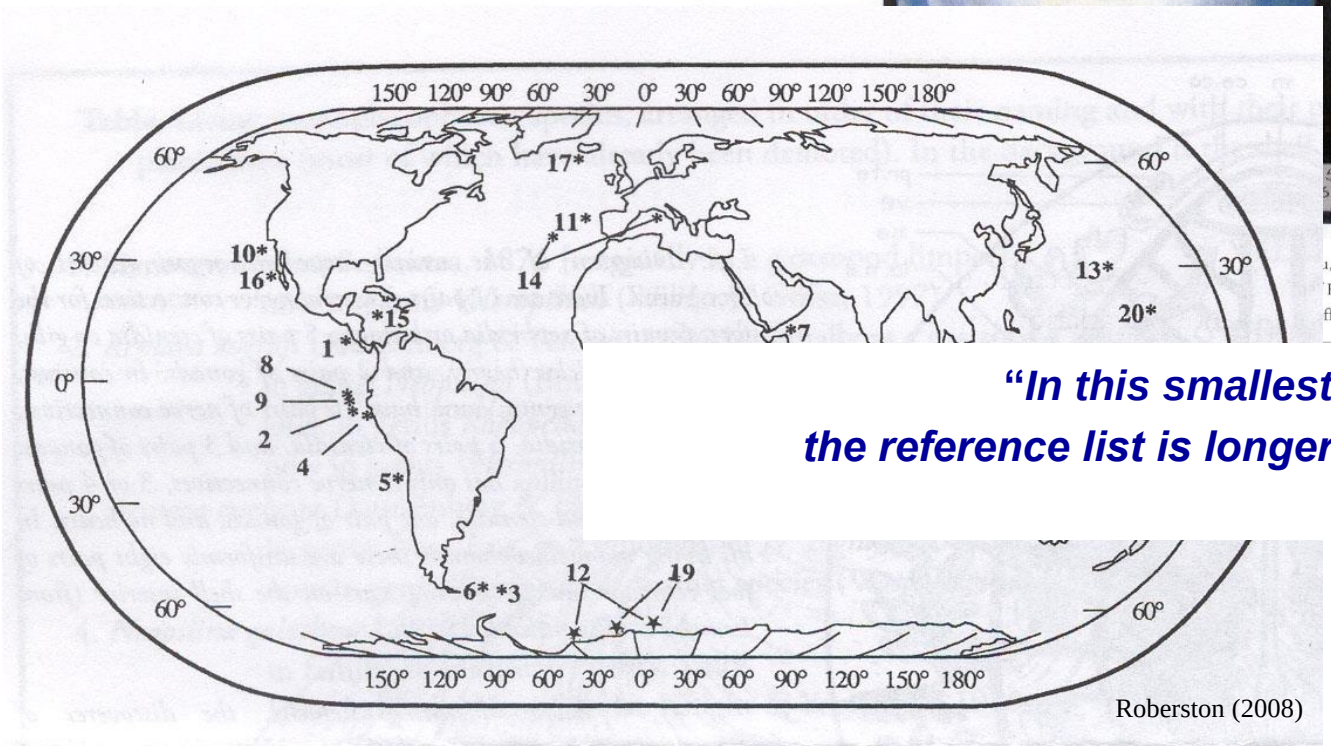
Neopilina (N.) bruuni (Menzies 1968: 2; figs. 1c, 4A–E, 5): 15 mm; Milne-Edwards Deep, Peru-Chile Trench, 4,823–4,925 m.

Neopilina (Lemchephiala) rebainsi (Moskalev et al. 1983: 988, figs. 5, 7–9): 21 mm; SE off Falkland Islands, 56°29,0´S, 50°51,1´W, 4,660–5,630 m.

Genus *Vema* Clarke and Menzies, 1959



ı, 3,909–6,354 m.
Falkland Islands, 1,627–2,044 m.
ff North Chile, 4,600 m.



Roberston (2008)

"In this smallest of molluscan classes, the reference list is longer than the species list."
(Robert Robertson, 2008)

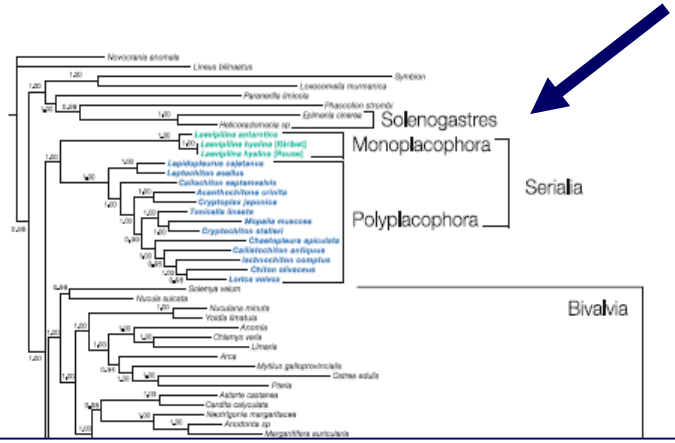
However, the tergomyan-cyclomyan distinctness, and the respective dichotomy, is only valid if the mantle retractors are ignored, the insertion areas of which form the pallial line in bivalves or limpets. If, based on extant representatives of both shell shapes, the pallial lines (i.e., the insertion dots of the mantle retractor muscles) are considered (Figure 5.1), the principal differences become educed only to the relative position of the pex. Such variability is present among extant axa in the Patellogastropoda and even within

Haszprunar (2008)

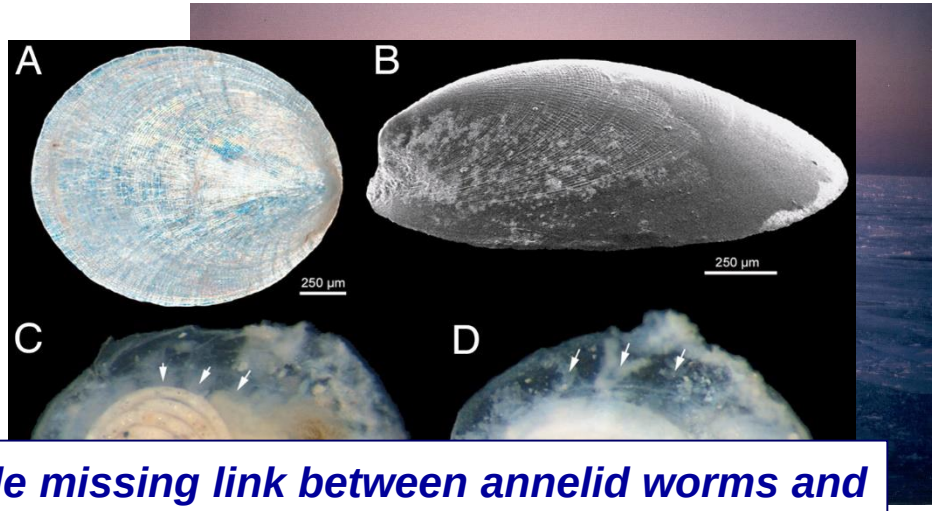
- **weltweites Vorkommen, aber nur wenige Individuen**

Zur Phylogenie und Evolution der Mollusca

- **Stellung mono- und aplacophorer Weichtiere**

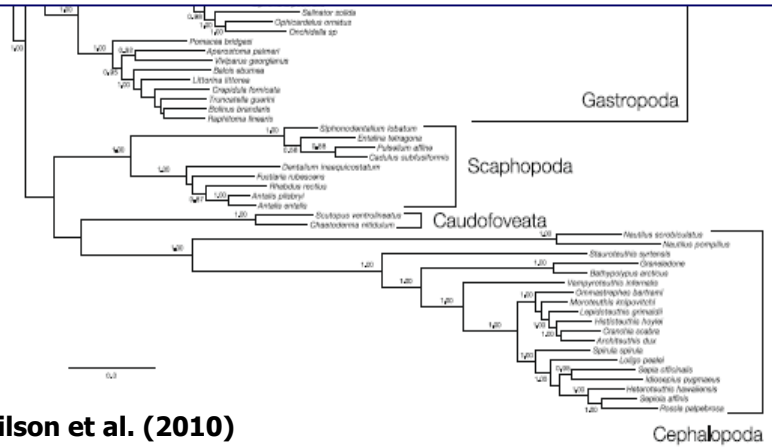


ANDEEP III (2005) - Expedition



"What was once thought to be a possible missing link between annelid worms and mollusks now appears to be a highly specialized branch on the molluscan tree that tells us little about the ancestral mollusk condition."

(David Lindberg, 2009)



Wilson et al. (2010)

Serialia Hypothese – Giribet et al. (2006):

nahe Verwandtschaft von Monoplacophora und Polyplacophora (aufgrund 28S rRNA)

„a* revolution *in molluscan systematics, with implications for metazoen evolution"

?

Systematische Zoologie

- **Die Vorlesung – *Was werden Sie hören ?***

Biodiversität der Tiere 9:45-11:15 Großer Hörsaal
61-011 Systematische Zoologie

Termin	KW	Datum	Thema	
1	14	2. Apr.	Einführung Zool. Systematik, Protista	
2	15	9. Apr.	Einführung, Metazoa	
3	16	16. Apr.	Metazoa, Bilateria	Protostomia
4	17	23. Apr.	Platyzoa - Mollusca	
5	18	30. Apr.	Annelida - Nematoda	
6	19	7. Mai.	Ecdysozoa: Chelicerata	
7	20	14. Mai.	Crustacea	
		Christi Himmelfahrt 21. Mai		
8	22	28. Mai.	Myriapoda - Insecta	
		Pfingstunterbrechung 4. Juni		
9	24	11. Jun.	Deuterostomia, Echinodermata	Deuterostomia
10	25	18. Jun.	Acrania, Pisces - Amphibia	
11	26	26. Jul.	Reptilia - Aves	
12	27	02. Jul 20	Mammalia	
	30	24. Jul 20	Haupttermin (Freitag)	
	40	02. Okt 20	Wiederholungstermin (Freitag)	